The relationship between appearance anxiety and depression among students in a medical university in China: A serial multiple mediation model

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Abstract

Background. Appearance anxiety is a popular topic in adolescence. Adolescents tend to be more sensitive to their appearance, and may be at higher risk for depression. However, few studies have revealed the mechanisms linking appearance anxiety and depression among medical college students. This study aimed to explore the multiple mediating roles of interpersonal sensitivity and social support between appearance anxiety and depression among medical college students. **Methods.** A total of 737 participants took part in the survey. With invalid 13 invalid samples excluded, 724 college students completed questionnaires containing basic demographic characteristics, Appearance Anxiety Scale, Interpersonal Sensitivity Scale, Perceived Social Support Scale, and Depression Scale. The average age of 724 samples is 19.8±2.02 including freshman to senior year and graduate school and above; 31.9% of the participants were male and 68.1% were female. Hayes' PROCESS macro is used for SPSS. **Results.** Appearance anxiety can not only directly affect depression, but also indirectly affect depression through three significant mediating pathways: (1) IS (B=0.106, 95% CI [0.082-0.132]), which accounted for 49.77% of the total effect, (2) SS (B=0.018, 95% CI [0.008-0.031]), which accounted for 8.45% of the total effect, and (3) IS and SS (B=0.008, 95% CI [0.003-0.014]), which accounted for 3.76% of the total effect. The total mediating effect was 61.97%. **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 relevant departments should take measures to reduce the interpersonal sensitivity of college students and establish reliable social support, so as to reduce 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. The prevalence of depression in college students was significantly higher than that of middle and elementary school students[1], especially in the medical college. Study has demonstrated that about 22% of college students in China suffer from depression[1], and the prevalence of depression among Chinese medical students is 27%[2]. So this shows that college students have an increasing risk of depression than others. Depression and anxiety are multifactorial and complex psychological problems with possible risk factors including psychological, academic, biological, lifestyle, social and economic. In psychology, for example, students with higher neurotic and more introverted are more likely to be depressed from psychological view. Multiple college-related poor lifestyles such as smoking, drinking, and substance abuse also increase the risk of depression among college students. Having a supportive social network, like family and friendships, can also influence a student's mood and reduce the likelihood of depression. If suffering from depression, students, especially medical students, are

60 more likely to give up solving complex problems and feeling confused during their study[3-5].
61 These behaviors may lead to hypertension, obesity, diabetes and other diseases in the future,
62 which seriously reduce the quality of life and increase the economic burden[6] More importantly,
63 the global suicide rate caused by depression is increasing every year and depression is a major
64 risk factor for adolescents' suicide[3]. According to existing studies, although there are many
65 factors influence adolescents' depression, such as anxiety, appearance satisfaction, interpersonal
66 sensitivity, and social support, the complex relationships among the influencing factors are still
67 unclear and need to be further investigated[7-10]. Adolescence is a time when individuals go
68 through major physical and psychological changes as they grow up, during which adolescents
69 pay special attentions to their image and are susceptible to the influence of the mass media's
70 aesthetic standards for appearance and figure, etc. If they realize that they do not meet such
71 standard, they are prone to appearance anxiety, which is likely to lead to further depression.[11]

72 Appearance anxiety (AA) refers to a condition when an individual is overly concerned
73 about their appearance. They may become inconfident and anxious about their appearance when
74 they perceive social standards or poor evaluations of themselves from others[12].With the
75 increasing rate of science and technology development, various social platforms and media have
76 become flourishing and have been invading in college students' lives[13]. They gradually begin
77 to pay excessive attention to their appearance and worry about others' evaluation about their
78 appearance. And these may even trigger their anxiety[14]. Some studies have pointed out that
79 adolescence is a time in human development when they go through drastic physical and
80 psychological changes. During adolescence, students pay more attention to their looks and are
81 always unconsciously exposed to unrealistic standards of beauty, appearance or body type from
82 the mass media. Their self-esteem probably declines if they think that they do not meet these
83 standards, resulting in anxiety and depression[15]. Appearance influence the formation and
84 establishment of self-esteem in adolescence and young adulthood. Anxiety about appearance
85 make them to become negative due to lack of confidence, which leads to a decrease in the level
86 of self-esteem of the individual[11], resulting in an inability to integrate into society and to
87 positively face the challenges of interpersonal relationships. Therefore, it is necessary to make a
88 further study on the effect of AA on depression among medical college students in order to
89 explore ways to reduce the rate of depression among them. Advances in a cognitive behavioral
90 model of body dysmorphic disorder proposed that when individuals compare themselves to the
91 least likely ideal appearance, they generates negative emotions, which lead to self-protective
92 behaviors such as avoidance[16, 17]. Some adolescents may be bullied, harassed, and ridiculed
93 because of their appearance, which exacerbates adolescents' AA and gradually develops distorted
94 perceptions and aversion to their own appearance[17, 18]. When adolescents compare
95 themselves upward with others or compare their ideal selves with their real-life selves, a
96 discrepancy is created, which can lead to emotional vulnerability, anxiety and exacerbate
97 depression[19, 20]. Anabolic-androgenic steroid users are at greater risk of depression if they
98 have defective appearances[21]; Dissatisfaction with physical appearance can act as a mediator
99 to influence the relationship between self-esteem and depression[7]. Appearance influences the

100 formation and establishment of self-esteem in adolescence and young adulthood. External
101 anxiety can lead to a lack of confidence and negativity and further a decrease in an individual's
102 level of self-esteem, resulting in an inability to integrate into society and positively face the
103 challenges of interpersonal relationships[22]. Hairi et al. found that a person's dissatisfaction
104 with his or her appearance can lead to lowered self-esteem, which in turn can trigger
105 depression[15]. A study in Coimbatore showed that 77.6% of college women were dissatisfied
106 with their body image and that depression was significantly associated with it[23]. At the same
107 time, anxiety and depression are closely related--they are comorbidity, and anxiety is a risk
108 factor for depression[24]. Studies have demonstrated that elevated levels of anxiety are
109 associated with depression among college students in Latin America[10]. Based on existing
110 studies, it can be reasonably speculated that medical college students' dissatisfaction with their
111 appearance is likely to cause AA, which in turn increases the likelihood of depression.

112 Interpersonal sensitivity (IS) is one of the mental health problems faced by contemporary
113 college students[25]. IS was first proposed by Boyce and Parker and is considered as a
114 personality trait that usually manifests itself as an over-understanding of the behavior and
115 emotions of others[26]. Individuals sometimes pay too much attention to their own
116 relationships and fear the rejection or criticism of others in social interactions, which is also
117 a symptom of IS[8]. Discomfort and anxiety will happen in people with IS trait when they are
118 interacting with people. Such discomfort leads to social anxiety and a strong sense of low-
119 esteem, making individuals vulnerable to develop into depression. They also often change their
120 behavior to conform to the expectations and ideas of others[27, 28]. Some researchers have used
121 structural equation modeling to show that IS moderates anxiety states in participants who are
122 abused as children, and that also moderates AA in adolescents[29, 30]. Among Chinese college
123 students, negative emotion is related to IS and is one of the predictors of depression[8, 25].
124 Whether IS can be used as a mediating variable to moderate the relationship between AA and
125 depression among college students needs to be validated through further research.

126 Social support (SS) refers to a social network of family, friends, teachers and classmates
127 that provides emotional support and practical help to individuals[31]. When encountering
128 difficulties, college students can seek help from family, friends, etc., so as to obtain solutions to
129 problems, which greatly relieves physical and mental stress[8]. Therefore, SS is a key factor in
130 the mental health of college students and makes an important contribution to the mental health of
131 adolescents[32, 33]. Peirce et al. constructed a model based on social support theory and found
132 that SS was negatively associated with depression[34]; Study made by Jaycox et al. reported an
133 effect of social interaction on depression in adolescents[35]. SS can significantly reduce the
134 anxiety levels of community residents during the COVID-19 outbreak in Turkey in 2020[36].
135 Body image and SS in patients with Psoriasis were found to be major contributors to
136 depression[37]. Meanwhile, SS plays an important role in reducing depressive symptoms and IS,
137 and higher levels of SS can reduce the severity of an individual's depressive symptoms and
138 IS[38].

139   Based on the available studies, it can be speculated that there is some relationship between
140   AA, IS, SS and depression. There are few studies on the mechanisms between AA and
141   depression among Chinese college students, studying in a medical school, and there is a lack of
142   studies demonstrating the mediating role of IS and SS in the relationship between AA and
143   depression. Therefore, this study aimed to investigate the relationship between AA, IS, SS, and
144   depression, as well as to explore the multiple mediating roles of IS and SS between AA and
145   depression in medical college students. The purpose of this study is to reach a deeper
146   understanding of the factors influencing depression and to provide a theoretical basis for the
147   development of public health policies in relevant sectors. This is also to prevent depression at the
148   source, consciously reduce the risk of depression among medical college students and maintain
149   their physical and mental health at a high level. Based on the above, the following three
150   hypotheses are proposed:

151   H1: AA positively predicts depression among college students studying in a medical school.

152   H2: AA indirectly predicts depression through high IS among college students studying in a
153   medical school.

154   H3: AA indirectly predicts depression through low SS among college students studying in a
155   medical school.

156   H4: AA indirectly predicts depression through high IS and low SS among college students
157   studying in a medical school.

158

Materials & Methods

160   2.1. Participants and Procedure

161   This study adopted a cross-sectional survey. From February 2 to February 5, 2023, a
162   convenience sampling was used to recruit 737 college students for questionnaire survey at
163   Chongqing Medical University. Posters, applets, QR codes, and links are utilized to disseminate
164   and recruit research subjects. The inclusion criteria for this study were students who were
165   enrolled in Chongqing Medical University (including undergraduate, graduate and doctoral
166   students) and were willing to participate in this study. Respondents were briefed by professional
167   investigators on the survey content and purpose prior to the survey to seek informed consent. If
168   the subject is underage, investigators obtained informed consent from their guardians via the
169   Internet in advance. The questionnaire included the Basic demographic variables, the
170   Appearance Anxiety Scale-Brief Version (AASBV), the Perceived Social Support Scale (PSSS),
171   the SCL-90 Interpersonal Sensitivity Subscale and the Patient Health Questionnaire(PHQ-9).
172   The questionnaires were distributed and collected relying on the Questionnaire Star platform
173   online. The inclusion criteria were that the results of questionnaires have no missing items,
174   obvious logical errors and invalid numbers (e.g. the ones whose height are over 2.5m or less than
175   1m; the ones whose weight are less than 30kg or more than 125kg; the ones whose age are below
176   16 or bigger than 36). More precisely, all the participants were university students at Chongqing
177   Medical University and after removing missing and invalid data, the remaining sample size was
178   724.

179

180 2.2. Measurement

181 2.2.1. Appearance anxiety

182   Appearance anxiety was measured by the Appearance Anxiety Scale-Brief Version
183 (AASBV) written by Dion[39]. The Appearance Anxiety Scale-Brief Version consist of 14 items.
184 A 5-point Likert scale ranging from 1 (never) to 5 (almost always) is used, which reflects the
185 respondents' combined attitudes toward appearance anxiety with a total score ranging from 14 to
186 70. The higher the overall score is, the higher the degree of appearance anxiety is[40].The chosen
187 Chinese version of the Appearance Anxiety Scale is a short version of good reliability and
188 validity and the Cronbach's alpha measured was 0.876.

189

190 2.2.2. Social support

191   The Perceived Social Support Scale (PSSS) is used to measure social support[41]. Response
192 to an item was measured on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7
193 (strongly agree). It has 12 items in total, and the total score reflects the total social support felt by
194 the individual. The scale has three dimensions: family support, friends support, and others
195 support. The overall score between 12-36 is a low support status; 37-60 is a medium support
196 status; 61-84 is a high support status; the higher the overall score is, the higher the individual's
197 social support people have[42]. In this study, the Cronbach's alpha for the scale was 0.930.

198

199 2.2.3. Interpersonal sensitivity

200   The Symptom Check List-90 (SCL-90) is used to assess respondents' interpersonal
201 sensitivity[43]. The SCL-90 invented by Derogatis can be used to assess the intensity of self-
202 reported symptoms, and the scale contains a number of subscales. The Interpersonal Sensitivity
203 Subscale (9 items in total), one of the subscales, is used to assess the intensity of interpersonal
204 sensitivity among students at Chongqing Medical University. Responses to items are measured
205 on a 5-point Likert scale (0=none 4=critical), with a total score ranging from 0-36. Subscale
206 score greater than 2 indicates a psychological abnormality[44]. The Cronbach's alpha
207 measurement for this subscale is 0.855, which is more than 0.8 with high reliability.

208

209 2.2.4. Depression

210   The Patient Health Questionnaire (PHQ-9) is used to measure depression[45]. PHQ-9
211 consists of nine items for depression self-assessment. The efficiency and convenience of the
212 scale makes itself widely used in real life. It rated on a 4-point Likert scale with a score ranging
213 from 0 to 3 and a total score range of 0-27 on the scale. The cut-offs have been proposed as 0–4,
214 5–9, 10–14, 15–19 and 20-27 for no, mild, moderate, moderately severe and severe depression
215 respectively[46].The Cronbach's alpha for this component in this study was 0.852.

216

217 2.3. Statistical Analysis

218   This study used the Statistical Package for the Social Sciences (SPSS) version 25.0 to
219   analyze the data. Continuous variables are represented using mean and standard deviation
220   (M±SD), and categorical variables are expressed as frequency and percentage (n(%).Normality
221   test and uniformity of variance test are performed for measurement of AA, IS, SS, and
222   depression scores under different basic demographic characteristics, and further, a t-test on two
223   independent samples or variance homogeneity is performed to determine whether there was a
224   difference in the mean values of AA, IS, SS, and depression between different subgroups when
225   all samples were satisfied. Pearson's correlation was used to analyze the correlations between the
226   appearance anxiety, social support, interpersonal sensitivity and depression. To further
227   understand the relationship between the above variables, a serial multiple mediation model
228   (model 6) was performed using PROCESS macro 3.5 package provided by Hayes. Gender and
229   age were used as covariates, appearance anxiety as the independent variable (X), interpersonal
230   sensitivity and social support as mediating variables (M1, M2) and depression as the dependent
231   variable(Y). After the model was built, the mediation effects were tested using a bootstrap (5,000
232   bootstrap samples) based on 95% confidence intervals. If the 95% confidence interval for the
233   mediating effect does not include zero, the mediating effect will be significant at the 0.05 level.
234   The model of this study was tested to be significant at the 0.05 level.

235

236   **Results**

237   3.1. Basic Demographic Variables
238   All participants were asked to complete a questionnaire that included gender, age, grade,
239   height, weight, whether they were an only child, whether their home address was town or village,
240   monthly household income, GPA for the previous school year, and disposable income. Specific
241   issues and analysis results are shown in Table 1. As shown in Table 1, there are significant
242   differences in the mean of AA scores across grade levels and BMI index (F=3.402 P=0.009;
243   F=5.752 P=0.003). IS scores varied significantly by grade levels, home address, ranking of results
244   (F=2.738, P=0.028; F=2.113 P=0.035; F=-2.426 P=0.016). The average scores of SS varied
245   significantly across gender, grade, BMI, only a child, home address, monthly income, ranking of
246   results, single and discretionary income (F=2.228 P=0.026; F=2.682 P=0.031; F=3.367 P=0.001;
247   F=-3.004 P=0.003; F=-5.289 P<0.000; F=2.801 P=0.005; F=1.985 P=0.048; F=-3.584 P<0.000).
248   The mean of Depression scores varied with grade levels and ranking of results (F=2.679 P=0.031;
249   F=-2.885 P=0.004).

250

251

252   3.2. Correlation analysis
253   The correlation matrix of key study variables is presented in Table 2. IS and AA were
254   positively correlated (r = 0.568, p < 0.01); AA and IS were negatively correlated with SS (AA: r
255   = -0.323, p < 0.01; IS: r = -0.319, p < 0.01); AA and IS were positively correlated with
256   depression (AA: r = 0.438, p < 0.01; IS: r = 0.534, p < 0.01), and SS was negatively correlated
257   with depression (r = -0.344, p < 0.01).

258

259 3.3. Multiple mediation analyses of the hypothesized model

260   A multiple mediation analysis was conducted to explore the mediation effects of IS and SS
261 in a college student population. Control variables included gender, age, BMI, GPA, being an
262 only child or not and home address. AA and depression were entered as independent and
263 dependent variables respectively. The proposed mediators were IS and SS. Results of the
264 analysis (Table 3) showed that AA was positively correlated with depression (Index = 0.168, p <
265 0.001).   Secondly, AA was positively correlated with IS (Index = 0.575, p < 0.001) and
266 negatively correlated with SS (Index = -0.234, p < 0.001). IS was negatively correlated with SS
267 (Index = -0.179, p < 0.001). In addition, IS was positively correlated with depression (Index =
268 0.384, p < 0.001) and SS and depression were negatively correlated (Index = -0.161, p < 0.001).

269

270 3.4. Bootstrap test of mediators

271   The mediation path model is presented in Figure 1. To test the significance of the mediating
272 effect of IS and SS, a bootstrap estimation procedure with 5,000 bootstrap samples is performed.
273 The total effect, direct effect, and indirect effect are presented in Table 4. The path coefficients
274 for the 95% CI of the paths do not include 0 which means that the path coefficient of this path is
275 significantly true at the level of 0.05. As is shown in Table 4, the significance of the direct effect
276 of AA on depression (Effect=0.081, 95% CI [0.045-0.117]) remained when the mediators (IS
277 and SS) were included in the model. AA was found to indirectly affect depression psychological
278 stress through three significant mediation pathways: (1) IS (B=0.106, 95% CI [0.082-0.132]),
279 which accounted for 49.77% of the total effect, (2) SS (B=0.018, 95% CI [0.008-0.031]), which
280 accounted for 8.45% of the total effect, and (3) IS and SS (B=0.008, 95% CI [0.003-0.014]),
281 which accounted for 3.76% of the total effect. The total mediating effect was 61.97%.

282

283

284 **Discussion**

285   AA has long been a hot topic in young adults. At the stage of physical and mental maturity,
286 teenagers are delicate and sensitive, and they begin to care about their appearance, but external
287 pressure on their appearance leads to negative emotions. Liao's research shows that 78.8% of
288 medical students in China are concerned about their appearance, it shows that the problem of AA
289 is very serious among medical students, and high AA can lead to social anxiety and depression.
290 And medical students' focus on weight and figure may be related to AA[47].This study is the first
291 to explore the effects of IS and SS on adolescents' AA and depression in a sample of 724 at
292 Chongqing Medical University in Chongqing, China, and to investigate the effects of SS and IS
293 as mediating variables on AA and depression mechanism. The results of this study will
294 contribute to the early detection and timely intervention of depression among medical college
295 students and contribute to the healthy physical and mental growth of medical college students
296 studying in medical schools. Moreover, this research can also make up for the research gap in
297 this area at home and abroad in recent years, so as to have a certain impact on the prevention of

298   mental illness of college students. AA scores vary by grade and BMI, which is possibly because
299   contemporary society promotes the concept of "thinness" as beauty[47]. It leads students to pay a
300   lot of attention to their BMI, but further research is needed on the impact of grade level. As
301   mentioned in previous articles, the increasing of age is likely to lead to increased levels of
302   AA[48]. IS varies by grade, home address, and grades. Freshmen may be at higher risk of IS
303   because they have just entered a new environment and are mentally less mature than older
304   students[49]. SS varies by gender, grade, BMI, only a child, home address, monthly income,
305   ranking of results, single and discretionary income, and depression by grade and test score.
306   Especially students who are undergoing graduate exams in their senior year are more likely to
307   suffer from depression[50].
308   This study found that AA positively and significantly predicted the onset of depression in a
309   medical college student population, which is consistent with the findings of a study exploring the
310   relationship between appearance and psychological distress[51]. It is undeniable that appearance
311   is the most intuitive "first face" in human interaction, people can use make-up to strengthen the
312   confidence in their appearances, but it is more important to establish the correct concept of
313   appearance and lessen the chance of AA. Previous studies have found that if they are more
314   sensitive and attentive to their appearance than others, they may take a higher risk of
315   depression[51]. Depression is the leading cause of illness and disability among adolescents[52].
316   It is not that individuals will never have negative emotions such as depression and anxiety
317   without mental problems at present. Actually, mental health can change. Especially, for example,
318   in the early days of the exam, the numbers of students with depressive symptoms increase. This
319   is possibly due to excessive psychological stress and challenges. Facing the exam, they have less
320   time to unwind and thus psychological problems are exacerbated[50]. Therefore, more attention
321   should be attached to the mental health of medical students, especially at the examination stage.
322   The right amount of recreational activities and time with their families should be provided to
323   students at this stage to increase SS and reduce their depression. When depression occurs during
324   adolescence, they have a higher rate of recurrence of depression in the future and their quality of
325   life will be seriously affected, which will increase the economic and health burden of society[6,
326   53]. In this regard, the corresponding relevant departments (especially schools) should attach
327   high importance to the occurrence of depression among college students, conduct early mental
328   health screening in a timely manner, provide additional psychological support to students at risk,
329   and combine early detection with effective intervention in order to reduce the probability of
330   college students suffering from depression and aggravation of the condition[5]. At the same time,
331   actively guiding students to reduce their external evaluations of others, building a good
332   communication platform, and improving their coping and interpersonal skills can enable students
333   to receive more campus support.
334   This study shows that IS not only is a mental health problem for medical college students,
335   but also it has a great potential to affect depression in college students with appearance anxiety.
336   Medical college students with high IS are overly concerned about the feelings and behaviors of
337   others   and   fear   negative   evaluations   and   rejections   from   others,   therefore   they   are

338 psychologically fragile and sensitive. Such students are at high risk of losing themselves and
339 becoming depressed in order to avoid rejection and criticism. Previous studies have confirmed
340 that people with IS traits are more likely to develop depression[27]. In this regard, group
341 counseling has been widely used in intervention studies of interpersonal communication and
342 prevention of depression among college students with good results, and previous studies have
343 also confirmed that group sand tray game therapy can effectively reduce IS of college
344 students[54, 55]. Schools and other relevant departments can learn from the existing studies and
345 actively carry out activities such as group counseling and group sand tray games to help
346 individuals reduce IS and the occurrence of depression among college students.

347 This study confirmed the validity of hypothesis 3. SS is an important resilient resource for
348 individuals in social life and a protective factor for college students' physical and mental
349 health[56]. The result of this study indicating that higher SS can maintain a good emotional
350 experience for individuals, enhance the coping and handle ability of college students when
351 facing AA and reduce the anxiety and depression caused by appearance[57]. Specifically, SS
352 was negatively correlated with AA, IS, and depression. A decrease in SS can seriously affect
353 people's psychological state, leading to increase levels of anxiety and depression. As a previous
354 study shows, people with higher IS have lower SS, so people with higher SS are better able to
355 face and adapt to relationships[58]. Family and friends should give more love and accompany to
356 youth who is in sensitive periods, encourage and support them when they suffer setbacks, and
357 give them timely help when they encounter difficulties. State authorities should also give high
358 priority to the occurrence and treatment to depression among college students, help youth receive
359 reliable support and the benefits they deserve. and build a good platform to improve their coping
360 ability and interpersonal skills.

361 Findings in this study enriched the mediating influences of AA leading to depression:
362 college students with AA faced with higher SS or lower IS would reduce the occurrence of
363 depression. Also, the results found that IS was significantly and negatively correlated with SS
364 (r=-0.319, p<0.01), meaning that among college students with AA, those with lower IS received
365 more SS and thus reduced the incidence of depression. College students, especially medical
366 school students, are the backbone of social construction and development in the future. Although
367 youth is often considered to be the best stage of health, this is by no means a reason to neglect
368 the physical and mental health of college students. All departments should take active measures
369 to attach great importance to the physical and mental health of college students studying in a
370 medical school and draw a blueprint for a healthy and happy future together.

371

Limitations

373 Although all the hypotheses in the study are valid, the limitations in the study must also be
374 acknowledged. Firstly, it is a cross-sectional research method and the causal relationship among
375 AA, IS, SS and depression is unclear. So the longitudinal studies could be conducted on the basis
376 of this study to further explore the causal relationships between variables. Secondly, the study
377 was conducted about three months after the strictly prevention and control of COVID-19 has

378 been lifted in China, and because of the wearing of masks, people's anxiety about their
379 appearance may change, which is unknown. Another survey of AA can be conducted several
380 years later and compare it with this study to get conclusions. Thirdly, the population of this study
381 were students of Chongqing Medical University and due to the special nature of their specialties,
382 they will have a more scientific perception of physiological appearance than other college
383 students. If the findings of this study are to be extended to other specialties or schools, the
384 representative sample needs to be further expanded to reduce the error. In addition,
385 unfortunately, we did not further exclude people with previous or current major psychological
386 problems in our study, which may bias our findings.
387

Conclusions

389 The study confirmed that the four hypotheses mentioned in the introduction hold true.
390 Specifically, lower IS and higher SS can effectively reduce depression caused by AA among
391 Chongqing medical students. It also reconfirmed that AA can directly or indirectly influence the
392 occurrence of depression in medical college students. In this study, it is also found that the
393 presence of IS and SS works as mediator regulating the mechanism of action between AA and
394 depression. It helps to clarify the potential mechanisms between AA and depression. The aim is
395 to improve the physical and mental health of medical college students and appeal to the society
396 to give high priority to young people. Schools and other relevant departments can learn from the
397 existing studies and actively carry out activities such as group counseling and group sand tray
398 games to help individuals reduce IS and the occurrence of depression among college students
399 studying in medical schools. At the same time, medical college students should also actively
400 communicate with people around them, improve their interpersonal skills and avoid over-
401 interpreting the feelings and behaviors of others to reduce their own psychological burden.
402
403

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406

Ethics approval and consent to participate

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

Consent for publication

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

Availability of data and materials

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

Conflicts of Interest

417 The authors declare no conflict of interest.

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422 Each author has met the authorship requirements. X.X., Y.Z., X.Z., X.W. and X.D. wrote the
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684

685 **Table 1** Differences in Appearance Anxiety, Interpersonal sensitivity, Social
686 support, and Depression under different subgroups of basic demographic
687 characteristics.
688

Variable	n(%)	Appearance Anxiety	t/F(p)	Interpersonal sensitivity	t/F(p)	Social support	t/F(p)	Depression	t/F
Gender			-0.150(0.880)		0.424(0.672)		2.228(0.026)		-0.
Male	231(31.9)	39.98±8.76		12.48±5.71		58.91±11.22		6.68±4.17	
Female	493(68.1)	39.87±8.64		12.68±5.88		60.98±11.82		6.45±4.18	
Age				19.8±2.02					
Grade			3.402(0.009)		2.738(0.028)		2.682(0.031)		2.6
Freshman	256(35.4)	40.34±8.64		12.75±5.87		61.87±11.70		6.15±4.14	
Sophomore	236(32.6)	40.47±8.58		13.27±5.87		59.67±11.98		6.70±3.97	
Junior	167(23.1)	39.14±8.90		11.89±5.86		59.70±10.90		7.11±4.68	
Senior	53(7.3)	39.57±8.29		12.19±3.56		57.06±11.72		6.26±3.56	
Above	12(1.7)	31.83±5.27		8.92±3.06		63.25±11.19		3.92±2.75	
BMI			5.752(0.003)		0.739(0.478)		0.036(0.964)		0.3
<18.5	136(18.8)	38.20±8.71		12.15±5.17		60.25±11.95		6.29±4.30	
18.5-23.9	498(68.8)	39.97±8.41		12.79±5.90		60.39±11.85		6.55±4.16	
>23.9	90(12.4)	42.16±9.57		12.37±6.28		60.04±10.20		6.71±4.14	
the only child			0.611(0.542)		-0.459(0.646)		3.367(0.001)		-0.
Yes	290(40.1)	40.15±8.84		12.49±5.84		62.09±11.92		6.47±4.09	
No	434(59.9)	39.75±8.56		12.70±5.82		59.14±11.35		6.56±4.24	
Home address			-0.185(0.853)		2.113(0.035)		-3.004(0.003)		1.1
Township	244(33.7)	39.82±7.71		13.25±5.67		58.50±10.67		6.78±4.28	
City	480(66.3)	39.95±9.13		12.29±5.87		61.24±12.04		6.39±4.13	
Monthly income			0.218(0.827)		1.328(0.185)		-5.289(<0.000)		1.5
≤5,000	265(36.6)	40.00±8.52		12.99±5.83		57.36±11.37		6.84±4.29	
>5,000	459(63.4)	39.85±8.77		12.40±5.81		62.03±11.50		6.34±4.11	
Ranking of results			-0.677(0.499)		-2.426(0.016)		2.801(0.005)		-2.
top 50%	531(73.3)	39.78±8.27		12.30±5.69		61.05±11.22		6.26±3.92	
Post 50%	193(26.7)	40.27±9.71		13.48±6.11		58.32±12.62		7.26±4.75	
Single			1.696(0.090)		1.353(0.176)		1.985(0.048)		-0.
Yes	570(78.7)	40.19±8.66		12.77±5.83		60.77±11.40		6.48±4.16	
No	154(21.3)	38.86±8.68		12.05±5.78		58.67±12.50		6.69±4.25	
Discretionary income			-0.804(0.422)		0.799(0.424)		-3.584(<0.000)		0.2
<1,500	370(51.1)	39.65±8.54		12.78±6.05		58.81±11.29		6.56±4.18	
>1,500	354(48.9)	40.17±8.81		12.44±5.58		61.90±11.85		6.49±4.18	

689 **Table 2** Correlation analysis of appearance anxiety, interpersonal sensitivity,
690 social support, and depression.

	Variable	M±SD	①	②	③	④
☐	Appearance	39.91±8.67	1			
☐	Interpersonal	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

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

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693 **Table 3** Regression analysis of appearance anxiety, interpersonal sensitivity,
694 social support, and depression.

Regression model		Model fit index			Significance of regression coefficients	
Outcome Variables	Predictive Variables	R	R²	F	β	t
Interpersonal sensitivity	Appearance anxiety	0.582	0.338	52.310	0.575	18.648***
Social support	Appearance anxiety	0.417	0.174	18.825	-0.234	-5.569***
	Interpersonal sensitivity				-0.179	-4.289***
Depression	Appearance anxiety	0.583	0.340	40.790	0.168	4.370***
	Interpersonal Sensitivity				0.384	10.142***
	Social support				-0.161	-4.801***

695 *Note:*P<0.05,**P<0.01and***P<0.001*
696 *β is the normalization factor*

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702 **Table 4** Significance test for mediating effects of appearance anxiety,
703   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	0.019	0.045	0.117	38.03%
Total indirect effect	0.132	0.015	0.105	0.162	61.97%
Appearance anxiety→Interpersonal sensitivity→Depression	0.106	0.013	0.082	0.132	49.77%
Appearance anxiety →Social support→Depression	0.018	0.006	0.008	0.031	8.45%
Appearance anxiety→Interpersonal sensitivity→Social support→Depression	0.008	0.003	0.003	0.014	3.76%

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706   **Figure 1** Generalized linear model serial mediation
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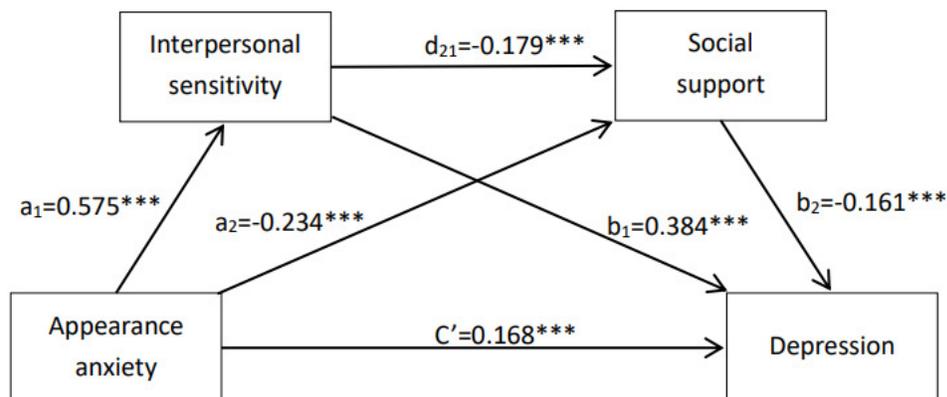
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Figure 1

Figure 1 Generalized linear model serial mediation

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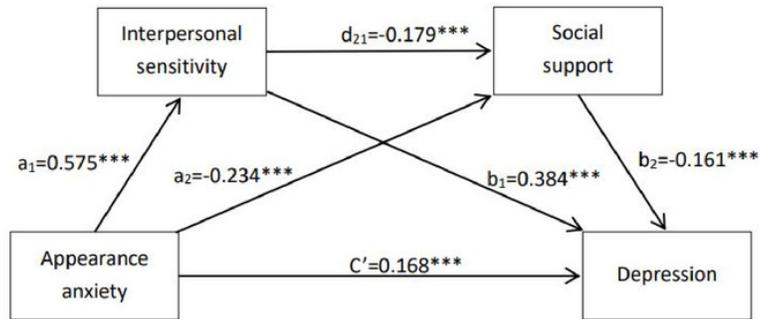
Differences in Appearance Anxiety, Interpersonal sensitivity, Social support, and Depression under different subgroups of basic demographic characteristics.

1 **Table 1** Differences in Appearance Anxiety, Interpersonal sensitivity, Social support, and Depression under

2 different subgroups of basic demographic characteristics.

Variable	n(%)	Appearance Anxiety	t/F(p)	Interpersonal sensitivity	t/F(p)	Social support	t/F(p)	Depression	t/F(p)
Gender			-0.150(0.880)		0.424(0.672)		2.228(0.026)		-0.701(0.483)
Male	231(31.9)	39.98±8.76		12.48±5.71		58.91±11.22		6.68±4.17	
Female	493(68.1)	39.87±8.64		12.68±5.88		60.98±11.82		6.45±4.18	
Age				19.8±2.02					
Grade			3.402(0.009)		2.738(0.028)		2.682(0.031)		2.679(0.031)
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Above	12(1.7)	31.83±5.27		8.92±3.06		63.25±11.19		3.92±2.75	
BMI			5.752(0.003)		0.739(0.478)		0.036(0.964)		0.308(0.735)
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Single		1.696(0.090)	1.353(0.176)	1.985(0.048)	-0.569(0.570)
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Regression analysis of appearance anxiety, interpersonal sensitivity, social support, and depression.

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☐ Social support	60.32±11.66	-0.323**	-0.319**	1	
☐ Depression	6.52±4.18	0.438**	0.534**	-0.344**	1

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

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

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