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Overweight/obesity and depressed mood in Chinese adults: A stratified test

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This study investigated the relationship between overweight/obesity and depressed mood in Chinese adults, examining the influence of factors such as age, gender, and place of residence. We conducted statistical tests on data from 10,833 participants of the 2018 Chinese General Social Survey (CGSS), using multiple linear regression analysis and stratified linear regression analysis. The results showed a significant and negative association between overweight/obesity and depressed mood, in which those who were overweight/obese had fewer instances of depressed mood. We found the negative correlation between overweight/obesity and depressed mood to be more significant in the Fortunate Generation cohort group and the urban group, and there was also a significant and negative association between overweight/obesity and depressed mood for men. These findings clarify the association between overweight/obesity and depressed mood as well as provide guidance for the development of relevant policies that target prevention and control.

Keywords
overweight, obesity, depressed mood, generational differences, gender differences

Article Highlights

- We found a significant and negative correlation between overweight/obesity and depressed mood.
- The negative correlation between overweight/obesity and depressed mood was more significant in the Fortunate Generation cohort group.
- The negative correlation between overweight/obesity and depressed mood was more significant in the urban group.
- The negative correlation between overweight/obesity and depressed mood was more significant among men.

Depression is a chronic mental illness that seriously jeopardizes physical and mental health, and it is clinically manifested by marked and persistent depressed mood (Swann et al., 2013). *Depressed mood* is a temporary, short-term, emotional state induced by a specific event such as failure, disappointment, or frustration that may lead to low mood, negativity, and poor mental health (Rottenberg, 2017). However, maintaining this low depressed mood for a prolonged period of time can lead to depression (Brandt & Boucher, 1986). It is estimated that more than 300 million people worldwide suffer from depression, which has been recognized by the World Health Organization as one of the leading

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causes of the global burden of mental health-related illness (Luo et al., 2018). The Global Burden of Disease 2019 shows that the number of cases of depression in Chinese residents has increased nearly 31% between 1990 and 2019 (31.3 million to 41 million); meanwhile, the disability-adjusted life year (DALY) rate has increased nearly 15%, rising from approximately 4.64 million person-years to 5.32 million person-years (Guo et al., 2022). Therefore, the monitoring and prevention of depression in Chinese residents has become an urgent and realistic problem.

With socioeconomic development and lifestyle changes, overweight/obesity has also become a global public health problem (Maślak et al., 2020). Hao et al. (2022) found that the overweight/obesity rate of adults aged 18–35 years in China increased from 12% to 36.8% between 1989 and 2018. The relationship between overweight/obesity and depression has been widely documented with numerous studies (Dong et al., 2004; Nemiary et al., 2012; Simon et al., 2008) showing a significant and positive association between overweight/obesity and depression among adolescents, middle-aged women, and adults in general. Relevant systematic reviews and meta-analyses (Luppino et al., 2010; Preiss et al., 2013) have also found that overweight/obesity increases the risk of depression in people. Liang (2014) extended these findings by postulating reasons overweight/obese patients develop anxiety and depression, including large body weight, easy fatigue, and lack of physical activity and socialization. However, little research has examined whether overweight/obesity is also associated with temporary, short-term depressed mood. Therefore, this study proposed that there will be a significant and positive correlation between overweight/obesity and depressed mood in Chinese adults.

Method

Participants and Procedure

We collected data from the Chinese General Social Survey (CGSS) 2018 database in May 2022 for this study. The CGSS is the earliest national, comprehensive, and continuous academic survey program in China, which systematically collects data at multiple levels of society, including communities, families, and individuals. It explores topics of great scientific and practical significance and serves as a multidisciplinary platform for economic and social data collection (Chinese General Social Survey, 2023). Since the CGSS is a public, open and shared database, there is no need to provide ethical certification for this study. After excluding data with invalid responses (such as “don’t know”, “refused to answer”, etc.), the survey data of 11,989 participants remained. After further excluding 25 participants who did not answer the question about their educational attainment and 1,131 participants who were underweight, the data of 10,833 participants remained.

The age of participants ranged from 18 to 101 years old (M = 51.95, SD = 16.17). Overall, 11.3% of the participants were born before 1949, 20.3% were born between 1950 and 1959, 20.6% were born between 1960 and 1969, 20.0% were born between 1970 and 1979, 14.4% were born between 1980 and 1989, 10.9% were born between 1990 and 1999, and 2.4% of participants were born after 2000. In addition, 48.0% were men and 52.0% were women. The majority (71.4%) were urban residents. Regarding education, 35.7% had completed primary school or less; 28.2% had completed junior school; 18.7% had completed senior school, junior college, or technical school; and 17.3% had graduated college. The mean body mass index (BMI) of the participants was 23.49 kg/m^2 (SD = 3.15), and the percentage of overweight/obesity was 39.0%. The mean socioeconomic status (SES) of the participants was in the lower middle class (4.24, SD = 1.67), and the mean depression level was in the lower class (2.10, SD = 0.95).

Measures

Dependent Variable

The dependent variable of this study was depressed mood. CGSS 2018 included a question asking the participants to assess their level of depressed mood in the past four weeks using a 5-point Likert scale, with higher scores indicating lower levels of depression. Taking into account the objective of this study, the scores were reversed during analysis with higher scores indicating a more depressed mood.

Independent Variable

The independent variable of this study was overweight/obesity. We calculated the BMI using the height and weight of the participants provided in CGSS 2018 according to the formula BMI = weight (kg)/height $(m)^2$. For adults in China, a BMI of below 18.5 kg/m^2 is considered underweight, 18.5–23.9 kg/m^2 is considered normal, 24.0–27.9 kg/m^2 is considered overweight, and above 28.0 is considered obese (Zhang et al., 2017). On the basis of these measures, we assigned a value of 1 to participants with a BMI of 24.0 kg/m^2 or more, which was the overweight/obesity group, and a value of 0 to the group with a BMI of 18.5 to 23.9 kg/m^2, which was the normal weight group.

Control Variables

Our control variables included age, gender, education, residence, and SES. We calculated the age of the participants through subtracting their year of birth, which was provided in the CGSS 2018 database, from the year the study was conducted (2018). For gender, we assigned "man" a value of 1 and "woman" a value of 0. Referring to Feng and Shi (2022), we categorized educational level as 1 = no education, private school, literacy class, or primary school; 2 = primary school and below, or junior school; 3 = senior school, junior college, or technical school; and 4 = junior college, undergraduate school, graduate school, and above. The CGSS 2018 database records the residence of the respondents, and we coded these as 1 = urban and 0 = rural. Participants judged their current economic status using a 10-point Likert scale, with higher scores indicating higher SES.

We grouped our respondents into three categories by adapting the technique of Zou and Ma (2019), who classified their participants as those born "before the founding of The People's Republic of China (PRC)" (≥ 69 years old), "after the founding of the PRC and before the reform and opening up of the country" (40–68 years old), and "after the reform and opening up of the country" (≤ 39 years old). We classified residents ≥ 69 years old as the "Traditional Generation (TDG)," embodying traditional norms, a strong sense of historical mission, and the ideals of serenity and harmony; residents aged 40–68 years old as the "Fortunate Generation (FTG)," which identifies with the spirit of striving, focuses on the realization of self-worth, and has a strong concept of collectivism; and residents aged ≤ 39 years old as the "Transitional Generation (TNG)," which focuses on the ego and subjective feelings, pursues personal success and wealth, and has a clear tendency of individualism and hedonism.

Data Analysis

This study used SPSS 21.0 and Stata 12.0 software for data processing and statistical analysis. Descriptive statistics were performed using mean and standard deviation for continuous variables and frequency and scale percentage for categorical variables. After controlling for relevant variables, we constructed multiple linear regression analyses, using depressed mood as the dependent variable and overweight/obesity as the independent variable. In addition, we took into account birth cohort, gender, and residence, using age, gender, and residence as stratification variables, respectively. To analyze the differences between the stratified regression coefficients, we used the *Z*-test with the following formula:

$$Z = \frac{b_1 - b_2}{\sqrt{SE_1^2 - SE_2^2}}$$

where b_1 and b_2 are the regression coefficients of the two groups of moderating variables, and SE_1^2 and SE_2^2 are the squares of the standard errors of the regression coefficients of the independent variables in the two groups of moderating variables. The statistical methods involved in this study were set at $\alpha = .05$.

Results

Relationship Between Overweight/Obesity and Depressed Mood

Table 1 shows that there was a significant and negative correlation between overweight/obesity and depressed mood, meaning that people who were overweight/obese had a lower level of depressed mood compared with those who were of normal weight. In addition, men had lower scores for depressed mood than women, residents with junior education or above had lower scores for depressed mood than residents with primary education or below, and residents in urban areas had lower scores for depressed mood than residents in rural areas. In addition, there was a significant and negative correlation between SES and depressed mood, but the correlation between age and depressed mood was not significant.

Table 1. *Multiple Linear Regression Analysis of Overweight/Obesity and Depressed Mood*

Variable	β	*SE*	*t*	*p*	95% CI	
					LL	*UL*
Overweight/obese (RG = No)	−.06	0.02	−3.17	< .001	−0.09	−0.02
Age	.00	0.00	0.83	.41	−0.00	0.00
Gender (RG = Women)	−.10	0.02	−5.42	< .001	−0.13	−0.06
Educational level (RG = Primary school and below)						
Junior school	−.18	0.02	−7.60	< .001	−0.23	−0.13
Senior school, junior college, technical school	−.25	0.03	−9.25	< .001	−0.31	−0.20
College and above	−.21	0.03	−6.63	< .001	−0.27	−0.14
Household residence (RG = Rural)	−.16	0.02	−7.50	< .001	−0.20	−0.12
Socioeconomic status	−.09	0.01	−16.38	< .001	−0.10	−0.08

Note. CI = confidence interval; *LL* = lower limit; *UL* = upper limit; RG = reference group.

Age Differences in the Relationship Between Overweight/Obesity and Depressed Mood

Table 2 shows a significant and negative correlation between overweight/obesity and depressed mood in the FTG cohort group, whereas this correlation was not found in the TDG and TNG cohort groups. The z value for TDG and FTG was calculated as $z = 6.43$, $p < .01$; the z value for TDG and TNG was calculated as $z = 0.63$, $p > .05$; and the z value for FTG and TNG was calculated as $z = –0.93$, $p > .05$. Thus, only the TDG and FTG groups showed cohort variability in the association between overweight/obesity and depressed mood in Chinese adults.

For the control variables, men in the FTG and TNG cohort groups had lower scores for depressed mood, residents above senior school in the TDG cohort group had lower scores for depressed mood, residents above junior school in the FTG and TNG cohort groups had lower scores for depressed mood, and urban residents in the FTG and TNG cohort groups had lower scores for depressed mood. The negative correlation between SES and depressed mood was reflected in any cohort, whereas the correlation between age and depressed mood was not significant in any age group.

Table 2. *Age Differences in the Relationship Between Overweight/Obesity and Depressed Mood*

Variable	TDG (n = 2,618)		FTG (n = 6,462)		TNG (n = 1,753)	
	β	*SE*	β	*SE*	β	*SE*
Overweight/obese (RG = No)	−.00	0.04	−.09**	0.02	−.04	0.05
Age	−.00	0.00	−.00	0.00	.01	0.00
Gender (RG = Women)	−.05	0.03	−.11**	0.02	−.13**	0.05
Educational level (RG = Primary school and below)						
Junior school	−.07	0.06	−.19**	0.03	−.16**	0.06
Senior school, junior college, technical school	−.18**	0.07	−.25**	0.03	−.28**	0.07
College and above	−.14*	0.06	−.21**	0.05	−.17*	0.09
Household residence (RG = Rural)	.04	0.05	−.19**	0.03	−.24**	0.05
Socioeconomic status	−.07**	0.01	−.10**	0.07	−.09**	0.01

Note. TDG = Traditional Generation (≥ 69 years old); FTG = Fortunate Generation (40–68 years old); TNG = Transitional Generation (≤ 39 years old); RG = reference group.

Gender Differences in the Relationship Between Overweight/Obesity and Depressed Mood

Table 3 shows that there was a significant and negative correlation between overweight/obesity and depressed mood among men after controlling for the relevant variables, whereas the correlation between overweight/obesity and depressed mood among women was not significant. In addition, β was –0.09 and –0.03 for men and women, respectively, and *SE* was 0.03 for both, $z = -1.429$, $p > 0.05$. Therefore, there was no gender difference in the relationship between overweight/obesity and depressed mood in Chinese adults. For the control variables, the results were similar to the overall effect results for men and women; thus, there were no gender differences.

Table 3. *Gender Differences in the Relationship Between Overweight/Obesity and Depressed Mood*

Variable	Men (n = 5,199)		Women (n = 5,634)	
	β	*SE*	β	*SE*
Overweight/obese (RG = No)	−.09**	0.03	−.03	0.03
Age	.00	0.00	.00	0.00
Educational level (RG = Primary school and below)				
Junior school	−.14**	0.03	−.20**	0.03
Senior school, junior college, technical school	−.18**	0.04	−.31**	0.04
College and above	−.18**	0.04	−.21**	0.05
Household residence (RG = Rural)	−.08**	0.01	−.21**	0.03
Socioeconomic status	−.07**	0.01	−.09**	0.01

Note. RG = reference group.
* $p < .05$. ** $p < .01$.

Urban–Rural Differences in the Relationship Between Overweight/Obesity and Depressed Mood

Table 4 shows that there was a significant and negative correlation between overweight/obesity and depressed mood in the urban group after controlling for the relevant variables, whereas the correlation between overweight/obesity and depressed mood in the rural group was not significant. In addition, β was –.07 and –.02 and SE was 0.02 and 0.04 for the urban and rural groups, respectively, $z = 3.571$, $p < .05$. Therefore, there was an urban–rural difference in the

relationship between overweight/obesity and depressed mood among Chinese adults. For the control variables of gender, education level, and SES, the results were similar to the overall effect results for both men and women, and there were no urban–rural differences, while for age, the correlation between age and depressed mood was not significant for the urban group, and there was a significant and positive correlation between age and depressed mood for the rural group.

Table 4. *Urban–Rural Differences in the Relationship Between Overweight/Obesity and Depressed Mood*

Variable	Urban (n = 7,730)		Rural (n = 3,013)	
	β	*SE*	β	*SE*
Overweight/obese (RG = No)	−.07**	0.02	−.02	0.04
Age	−.00	0.00	.01**	0.00
Gender (RG = Women)	−.07**	0.02	−.19**	0.04
Educational level (RG = Primary school and below)				
Junior school	−.15**	0.03	−.18**	0.04
Senior school, junior college, technical school	−.25**	0.03	−.19**	0.07
College and above	−.20**	0.03	−.39**	0.11
Socioeconomic status	−.09**	0.01	−.09**	0.01

Note. RG = reference group.
* $p < .05$. ** $p < .01$.

Discussion

This study explored the relationship between overweight/obesity and depressed mood among Chinese adults using data from the CGSS, analyzing age, gender, and place of residence as control variables. The results showed that there was a negative relationship between overweight/obesity and depressed mood among Chinese adults, which varied according to age and residence. Many studies (Mannan et al., 2016; Peng et al., 2019; Pinto et al., 2017) found that overweight/obese individuals are prone to experience strong feelings of low self-worth, isolation, frustration, stress, depression, and other negative emotional distress, which reduces their mental health and increases the likelihood of depressive symptoms. However, our results are not consistent with the above studies: we found that overweight/obese individuals were less likely to experience depressed mood. One possible explanation for this difference might be that the depressed mood mentioned in the above studies refers to the obvious and long-lasting low mood that accompanies depression (Swann et al., 2013). In contrast, we used a five-level self-assessment to assess the degree of individuals' depressed mood over the past four weeks, which is a temporary, short-term, mood state that may be triggered by a specific event, such as a failure, disappointment, or frustration (Rottenberg, 2017). Therefore, inconsistency in the dependent variable may be the reason for the variability among the results of this study and those in the current literature.

Our results are in line with some of the current literature. For example, Meng et al. (2012) found that individuals with lean body types are more likely to experience depression, while normal weight and overweight/obese individuals have a relatively low incidence of depression. In addition, Zhou et al. (2021) found that overweight/obese groups have a positive and optimistic approach to life, whereas thin groups have a more negative and depressed approach to life. However, the intrinsic mechanisms regarding lower BMI and depressed mood are not clear and need to be further explored in subsequent studies.

There were also age- and residence-level differences in the relationship between overweight/obesity and depressed mood. First, we found a significant and negative correlation between the two in the FTG cohort group; that is, older overweight/obese individuals were less likely to experience depressed mood than their younger counterparts. There are several possible reasons for the overweight/obese group of the FTG cohort reporting fewer instances of depressed mood. First, the unique social memories and lifestyle habits of the different age groups may lead to large differences in the rates of overweight/obesity and depression. Some studies (Shi et al., 2020; Starling, 2001) show that with the gradual increase in age, individuals' energy intake, consumption, and physical condition change, which is manifested in

lower physical activity and weight gain. As the older age group, the FTG cohort may have become accustomed to their physical state and learned to accept and adapt to it. Second, this age group is more focused on family, friends, and social activities, and such positive social interactions can help alleviate depressed moods (Santini et al., 2015; Steger & Kashdan, 2009). Third, moderate weight gain may, in some cases, lead to psychological benefits such as self-confidence and a sense of security (Brownell & Rodin, 1994). Last, in Eastern cultures, overweight/obesity is seen as a symbol of wealth and status (Ziraba et al., 2009); therefore, overweight/obese individuals are less likely to be discriminated against, thus reducing the incidence of depressed mood.

We also found that the relationship between overweight/obesity and depressed mood was stronger in urban groups; that is, the urban group had higher instances of depressed mood. This finding contrasts with those of Gu et al. (2018), in which the rural group had higher depression and suicidal tendencies. One reason for this difference might be that the urban group we studied had a higher ratio of overweight/obesity than the rural group, making it more likely for the relationship between the two to be reflected in the urban group. However, we have not yet found studies exploring the relationship between overweight/obesity and depressed mood based on an urban–rural difference perspective; thus, further investigation is needed.

Last, although we did not find gender variability in the relationship between overweight/obesity and depressed mood, we did find a more prominent association between overweight/obesity and depressed mood among men: that is, overweight/obese men were less likely to experience depressed mood than overweight/obese women. There may be several reasons for this difference. First, in Eastern cultures, being overweight or obese may be seen as a symbol of "wealth" for men compared to women (Ziraba et al., 2009), which may shield them from some degree of negative evaluation or discrimination. Second, group activities such as sports and social gatherings for men may play a moderating role, which in turn may help them release stress and improve their mood (Santini et al., 2015; Steger & Kashdan, 2009). In addition, some studies have shown that women report depression more frequently than men, and that overweight/obesity is more likely to cause feelings of loneliness, tension, sadness, depression, and stress in women (Li et al., 2021; Sun et al., 2023; Yang & Li, 2016). These higher instances of women reporting depression may also be related to their higher levels of emotional awareness and regulation compared with men (Thayer et al., 2003).

This study has limitations. First, the relationship between overweight/obesity and depressed mood is an interactional link rather than a unidirectional link, which cross-sectional studies cannot demonstrate. Thus, subsequent studies using a longitudinal research method such as cross-lagging are needed to support our research. Second, this study used subjective assessment by participants to record their depressed mood, which is a single-item assessment that may result in bias. Therefore, we recommend that future studies develop a temporary, transient depressed mood scale. Last, this study explored only the roles of age, gender, and residence as variables that may affect the relationship between overweight/obesity and depressed mood. Follow-up studies could test other demographic variables such as education level and socioeconomic status.

Conclusion

This study found a significant and negative correlation between overweight/obesity and depressed mood among Chinese adults, which varies according to age and residence. The negative correlation between overweight/obesity and depressed mood was more significant in the FTG cohort group, which was older, as well as in the urban group. In addition, this study found a significant and negative association between overweight/obesity and depressed mood in men. The findings of this study have positive implications for policy development, including recommendations to develop targeted strategies for preventing and controlling depressed mood by taking into account sociocultural factors, birth cohort, place of residence, and gender.

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References

Brandt, M. E., & Boucher, J. D. (1986). Concepts of depression in emotion lexicons of eight cultures. *International Journal of Intercultural Relations*, *10*(3), 321–346. https://doi.org/10.1016/0147-1767(86)90016-7

Brownell, K. D., & Rodin, J. (1994). The dieting maelstrom. Is it possible and advisable to lose weight? *American Psychologist*, *49*(9), 781–791. https://doi.org/10.1037/0003-066x.49.9.781

Chinese General Social Survey. (2023). *Chinese General Social Survey (CGSS): A data chronicle of social change in China* [In Chinese].

Dong, C., Sanchez, L. E., & Price, R. A. (2004). Relationship of obesity to depression: A family-based study. *International Journal of Obesity*, *28*(6), 790–795. https://doi.org/10.1038/sj.ijo.0802626

Feng, X. S., & Shi, P. (2022). Can the parental socio-economic status promote the children to participate in physical exercise? An empirical study based on the survey data of CGSS 2017. *European Review for Medical and Pharmacological Sciences*, *26*(12), 4188–4296. https://doi.org/10.26355/eurrev_202206_29055

Gu, L. X., Qi, Z. B., & Jia, C. X. (2018). Suicidal ideation and its influencing factors among rural doctors in Zoucheng, Shandong, China [In Chinese]. *Injury Medicine (Electronic Edition)*, *7*(2), 10–14.

Guo, R. Q., Hu, Y., Ran, S. H., Cheng, X. F., & Li, B. (2022). Analysis of the burden of disease and trend of change of depression among Chinese residents, 1990–2019 [In Chinese]. *Modern Preventive Medicine*, *49*(6), 981–985.

Hao, L. X., Zhang, B., Wang, H. J., Wang, L. S., Jiang, H. R., Wang, S. S. Z., ... Wang, Z. H. (2022). Changing trends and prevalence characteristics of overweight and obesity among adults aged 18–35 years in 15 provinces of China, 1989–2018 [In Chinese]. *Journal of Environmental and Occupational Medicine*, *39*(5), 471–477.

Li, X. M., Dai, J. M., Shen, Y. F., Fu, X. L., Chen, F. H., Gao, J. L., & Fu, H. (2021). Association analysis of body mass index and depressive symptoms among middle-aged and elderly people in Pudong New Area, Shanghai, China [In Chinese]. *Fudan University Journal of Medical Sciences*, *48*(2), 155–161.

Liang, M. (2014). Analysis of 60 cases of obese patients with anxiety and depression psychological survey [In Chinese]. *Nei Mongol Journal of Traditional Chinese Medicine*, *33*(3), Article 18. https://doi.org/10.16040/j.cnki.cn15-1101.2014.03.135

Luo, Y., Zhang, S., Zheng, R., Xu, L., & Wu, J. (2018). Effects of depression on heart rate variability in elderly patients with stable coronary artery disease. *Journal of Evidence-Based Medicine*, *11*(4), 242–245. https://doi.org/10.1111/jebm.12310

Luppino, F. S., de Wit, L. M., Bouvy, P. F., Stijnen, T., Cuijpers, P., Penninx, B. W. J. H., & Zitman, F. G. (2010). Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry*, *67*(3), 220–229. https://doi.org/10.1001/archgenpsychiatry.2010.2

Mannan, M., Mamun, A., Doi, S., & Clavarino, A. (2016). Prospective associations between depression and obesity for adolescent males and females—A systematic review and meta-analysis of longitudinal studies. *PLoS ONE*, *11*(6), Article e0157240. https://doi.org/10.1371/journal.pone.0157240

Maślak, A. D., Kusz, M., Pawluczuk, P., Alzubedi, A., & Polski, P. (2020). Causes of overweight and obesity in children and adolescents. *Journal of Education, Health and Sport*, *10*(5), 11–18. https://doi.org/10.12775/JEHS.2020.10.05.001

Meng, Z., Gao, J. J., & Fan, X. Z. (2012). A study of the relationship between body mass index and depression in patients with chronic heart failure [In Chinese]. *Chinese Nursing Research*, *26*(2), 118–119.

Nemiary, D., Shim, R., Mattox, G., & Holden, K. (2012). The relationship between obesity and depression among adolescents. *Psychiatric Annals*, *42*(8), 305–308. https://doi.org/10.3928/00485713-20120806-09

Peng, Z. W., Zheng, Z. Y., Yu, J. J., Jin, L. L., & Wei, Z. (2019). The relationship between Internet addiction and depression in overweight and obese adolescents [In Chinese]. *China Journal of Health Psychology*, *27*(8), 1131–1135. https://doi.org/10.13342/j.cnki.cjhp.2019.08.002

Pinto, I., Wilkinson, S., Virella, D., Alves, M., Calhau, C., & Coelho, R. (2017). Anxiety, family functioning and neuroendocrine biomarkers in obese children. *Acta Médica Portuguesa*, *30*(4), 273–280. https://doi.org/10.20344/amp.7919

Preiss, K., Brennan, L., & Clarke, D. (2013). A systematic review of variables associated with the relationship between obesity and depression. *Obesity Reviews*, *14*(11), 906–918. https://doi.org/10.1111/obr.12052

Rottenberg, J. (2017). Emotions in depression: What do we really know? *Annual Review of Clinical Psychology*, *13*, 241–263. https://doi.org/10.1146/annurev-clinpsy-032816-045252

Santini, Z. I., Koyanagi, A., Tyrovolas, S., Mason, C., & Haro, J. M. (2015). The association between social relationships and depression: A systematic review. *Journal of Affective Disorders*, *175*, 53–65. https://doi.org/10.1016/j.jad.2014.12.049

Shi, Z. L., Gu, J. X., & Fu, Q. (2020). Social change and health inequalities: An age-period-cohort analysis of the fifth disease transition [In Chinese]. *Sociological Study*, *35*(6), 160–185. https://doi.org/10.19934/j.cnki.shxyj.2020.06.008

Simon, G. E., Ludman, E. J., Linde, J. A., Operskalski, B. H., Ichikawa, L., Rohde, P., ... Jeffery, R. W. (2008). Association between obesity and depression in middle-aged women. *General Hospital Psychiatry*, *30*(1), 32–39. https://doi.org/10.1016/j.genhosppsych.2007.09.001

Starling, R. D. (2001). Energy expenditure and aging: Effects of physical activity. *International Journal of Sport Nutrition and Exercise Metabolism*, *11*, S208–S217. https://doi.org/10.1123/ijsnem.11.s1.s208

Steger, M. F., & Kashdan, T. B. (2009). Depression and everyday social activity, belonging, and well-being. *Journal of Counseling Psychology*, *56*(2), 289–300. https://doi.org/10.1037/a0015416

Sun, Z. Y., Liu, Z. H., Feng, B. J., Zhang, X. W., Xu, K., & Chen, L. (2023). Relationship between physical activity, sleep duration and overweight obesity and depressive symptoms in Tianjin middle school students [In Chinese]. *Chinese Journal of School Health*, *44*(4), 489–493. https://doi.org/10.16835/j.cnki.1000-9817.2023.04.003

Swann, A. C., Lafer, B., Perugi, G., Frye, M. A., Bauer, M., Bahk, W.-M., ... Suppes, T. (2013). Bipolar mixed states: An international society for bipolar disorders task force report of symptom structure, course of illness, and diagnosis. *The American Journal of Psychiatry*, *170*(1), 31–42. https://doi.org/10.1176/appi.ajp.2012.12030301

Thayer, J. F., Rossy, L. A., Ruiz-Padial, E., & Johnsen, B. (2003). Gender differences in the relationship between emotional regulation and depressive symptoms. *Cognitive Theory and Research*, *27*(3), 349–364. https://doi.org/10.1023/A:1023922618287

Yang, X. Y., & Li, X. Y. (2016). The relationship between overweight and obesity and depression and behavioral problems in adolescents [In Chinese]. *Chinese Mental Health Journal*, *30*(7), 519–526.

Zhang, M., Chen, J., Gan, Y. N., Ruan, B. Y., Wang, X., Liu, Y., ... Guo, H. L. (2017). A study of the diagnostic value of four commonly used criteria for assessing obesity in adults [In Chinese]. *Chinese General Practice*, *20*(22), 2732–2738.

Zhou, B., Zhang, Y. X., Zhou, Z. Q., Liang, C. S., & Liu, J. P. (2021). Progress of research on the correlation between BMI and depression and anxiety [In Chinese]. *Gansu Medical Journal*, *40*(7), 589–590.

Ziraba, A. K., Fotso, J. C., & Ochako, R. (2009). Overweight and obesity in urban Africa: A problem of the rich or the poor? *BMC Public Health*, *9*, Article 465. https://doi.org/10.1186/1471-2458-9-465

Zou, W., & Ma, Z. L. (2019). Family background, intergenerational transmission and educational inequalities [In Chinese]. *China Industrial Economics*, *371*(2), 80–98.

