



Association between personality traits and risk of suicidal ideation in Chinese university students: Analysis of the correlation among five personalities

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ABSTRACT

The purpose of our study was to determine the incidence of suicidal ideation among Chinese college students and to explore the risk factors for suicidal ideation. A large-sample epidemiological survey was conducted in 13 colleges in Chongqing, China ($n = 69,790$). Suicidal ideation was reported by 13.03% of the college students who were surveyed. The participants with suicidal ideation were more likely to be female, to come from rural areas, and to have poor life quality and psychological disorder compared to those without suicidal ideation. Moreover, this study revealed that neuroticism, psychoticism, impulsivity, and aggression are risk factors for suicidal ideation, while extroversion has a protective effect on suicidal ideation. We found that four personality traits of students with suicidal ideation, including impulsivity, aggression, psychoticism, and neuroticism, are positively correlated. However, there is a negative correlation between extroversion and the other four traits. These findings highlight the need for further exploration of personality traits in the risk of suicidal ideation.

1. Introduction

Suicide is the leading cause of death among people aged 15–24 years in China (Wang et al., 2008). In the fierce study and employment competition, the suicide rate of Chinese college students is significantly higher than that of non-college students of the same age, with the trend of increasing annually (Liu et al., 2010). Previous studies have confirmed that suicidal ideation is closely related to suicide (Oquendo et al., 2007; Reinherz et al., 2006; Sokero et al., 2002). Many people who committed suicide had thoughts of suicide and expressed this idea clearly to their relatives or friends in various ways before committing suicide (Oquendo et al., 2007).

Suicidal ideation, the early psychological activity of suicide attempt and suicide death, is the individual's desire to commit suicide; however, there are no explicit behaviors to commit suicide (Chen et al., 2017; Jing et al., 2016; Li et al., 2014; Shen et al., 2017). Studies in China have shown that the incidences of suicidal ideation among students range from 10% to 40% (Liu and Ling, 2007). Suicidal ideation is a vital

predictor of suicidal behavior (Thompson et al., 2012; Wong et al., 2005; Zhang et al., 2012; Zhao et al., 2012). Accordingly, understanding the current epidemiological situation and influencing factors in college students' suicidal ideation is of great significance for its future researches.

Suicidal ideation is associated with some internal factors, including sex (Hu and Wang, 2011; Liu and Ling, 2007; Zhang et al., 2012; Zhao et al., 2012) and personal psychological factors (e.g., anxiety and depression) (Fu et al., 2010; Schilling et al., 2009). It is also associated with some external factors, including quality of life (e.g., school factors, life events, and family factors) (Chen et al., 2013; Gao et al., 2003; Ming et al., 2011; Tang et al., 2015; Xia et al., 2015; Yang et al., 2017). It has been reported that personality traits are an important and relatively stable risk factor for suicide (Chang et al., 2015; Gao et al., 2007). What type of personality is prone to suicidal ideation? Some studies have demonstrated that some personality traits, including impulsivity, aggression, neuroticism, psychoticism, and extroversion, are significantly correlated with suicidal ideation (Dumais et al., 2005; Heisel et al.,

Abbreviations: SCL-90-R, symptom checklist-90 revised; BIS-CV, barratt impulsiveness scale-Chinese version; AQ-CV, the Chinese version of the buss & Perry aggression questionnaire; EPQ-RSC, eysenck personality questionnaire-r short scale for Chinese; IQR, interquartile ranges

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2006; Roy, 2002).

Different personality traits may have independent direct effects on suicide (Enns et al., 2003). However, there are interrelated roles between different personality traits, which may influence the effects of impulsive personality traits on suicide (Enns et al., 2003). Giegling's findings demonstrated that impulsive personality was associated with self-attack rather than explicit aggression, which also suggested an in-depth understanding of the relationship between the various personality traits (Giegling et al., 2009). Therefore, it is necessary to further study the magnitude and direction of the correlation between different personality traits.

Nevertheless, most Chinese studies on the association of personality traits and risk of suicidal ideation involve only one or two personality traits. The purpose of our study was to determine the incidence of suicidal ideation among 69,790 Chinese college students and to explore the risk factors for suicidal ideation. Our study focused on the influence of five personality traits on the risk for suicidal ideation, and we identified that psychological disorder and poor quality of life are the risk factors for suicidal ideation.

2. Methods

2.1. Participants

Participants were recruited from 13 universities in Chongqing, China, from September 2013 to November 2015. At each school, 30% of the total number of students who are in their first year of study were sampled, and the class was the minimum sampling unit. A total of 83,338 students were enrolled in this study, of which 72,246 participated in the questionnaire with a response rate of 86.7%. A total of 69,790 students completed the questionnaire, and 96.6% of the questionnaires were completed correctly. The survey was performed via a special website, and each enrolled student was assigned a unique encryption code. This study was approved by the Chongqing Medical University Ethics Committee. All students were informed of the aim of the study, the confidentiality of their personal information, and the principle of voluntary participation in the investigation. Accordingly, all students participating in this investigation provided their written informed consent.

2.2. Measurements

2.2.1. Preliminary investigation (Wang et al., 2012)

Before the formal investigation, a preliminary investigation was conducted to compare the reliability and validity of both online and paper versions of the mental health screening questionnaire for college students. For the online version, the Cronbach's α coefficient of total scale reached 0.755–0.972, and the coefficient of each subscale was 0.671–0.876. For the paper version, the Cronbach's α coefficient of total scale reached 0.711–0.963, and the coefficient of each subscale was 0.608–0.865. For the online version, the coefficients were all greater than 0.7, and the test of correlation coefficients was statistically significant ($P < 0.001$). The reliability was better, and validity of both content and construct were more reliable compared with the paper version.

2.2.2. Measure of suicidal ideation

Suicidal ideation was assessed using the Scale of Suicidal Ideation developed by the Beijing Center for Psychological Crisis Research and Intervention. Suicidal ideation was assessed for the previous months and years (Gosling et al., 2011). Suicidal ideation was assessed using four question items. All items were answered on a 4-point scale (0 = "never," 1 = "very few," 2 = "sometimes," 3 = "frequently"). A response of 2 or 3 to any of the four questions was considered to indicate suicidal ideation. The internal consistency of the scale reached 0.870 (Kayış et al., 2016).

2.2.3. Measure of quality of life

The Quality of Life Scale developed by the Beijing Center for Psychological Crisis Research and Intervention was used to assess the living conditions of the study subjects in the previous months (Xie, 2008). The scale included 6 subscales. Students with a response of 1 or 2 on the 5-point scale were classified as having a low life quality (1 = very poor, 2 = poor, 3 = fair, 4 = good, 5 = very good). The internal consistency of the scale was 0.865.

2.2.4. Measure of mental health

Mental health was assessed using the Chinese version of the Symptom Checklist-90 Revised (SCL-90-R) (Jiang and Wang, 2016; Wang, 1984). The SCL-90-R contains 9 subscales. Each question was rated on a 5-point Likert scale from 0 to 4, with higher scores suggesting psychological disorder status (0 for no distress and 4 for extreme distress). If the score of an item was ≤ 2 , the item was classified as positive. The screening criteria for psychological disorder included the following: a total score of > 160 on the SCL-9-R, > 43 positive items, or any domain score > 2 .

2.2.5. Measure of impulsive personality (Li et al., 2011a)

Impulsive personality traits were assessed using the Barratt impulsiveness scale-Chinese version (BIS-CV). The scale consists of 30 question items as well as 3 subscales. All items were answered on a 5-point Likert scale. The standardized formula for converting the score of the subscale to 0–100 points was expressed as follows: subscale score = [(sum of items' score - 10)/40] * 100; total score = (sum of 3 subscale scores)/3. Higher scores reflected stronger impulsivity of the participants. The Cronbach's α of the total and the three subscales ranged from 0.77 to 0.89, and the test-retest reliability ranged from 0.68 to 0.89.

2.2.6. Measure of aggressive personality (Li et al., 2011b)

Aggressive personality traits were assessed using the Chinese Version of the Buss & Perry Aggression Questionnaire (AQ-CV). The scale consisted of 30 question items as well as 5 subscales. All items were answered on a 5-point Likert scale. The standardized formula for converting the score of the subscale to 0–100 points was expressed as follows: subscale score of physical aggression and hostility = [(sum of subscale item scores - 7)/28] * 100; subscale score of verbal aggression and self-aggression = [(sum of subscale item scores - 5)/20] * 100; subscale score of anger = [(sum of subscale item scores - 6)/24] * 100; and total score of AQ-CV = [(sum of all items scores - 30)/120] * 100. Higher scores were interpreted as higher levels of aggression of the participants. The Cronbach's α of the total and the three subscales ranged from 0.60 to 0.89, and the test-retest reliability ranged from 0.54 to 0.81.

2.2.7. Measure of psychoticism, neuroticism, and extroversion (Qian et al., 2000)

The personality traits of psychoticism, neuroticism, and extroversion were assessed using the Eysenck Personality Questionnaire-R Short Scale for Chinese (EPQ-RSC). All items were answered on a 5-point Likert scale. The T-scores of EPQ-RSC scales from 43.3 to 56.7 were intermediate types, and those from 38.5 to 43.3 or 56.7 to 61.5 were prone types, and those below 38.5 or above 61.5 were typical types. The reliability of the *p*-subscales was between 0.54 and 0.60, and the reliability of the other three subscales was ranged from 0.74 to 0.78. The test-retest reliability of each subscale was 0.67 in the *p*-subscales, 0.88 in the *E*-subscales, and 0.78 in the *L*-subscales.

2.3. Statistical analysis

Statistical analysis was conducted using SPSS 20.0 (SPSS Inc., Chicago, IL, USA). The subjects were stratified into two groups in concordance with the result of the measure for suicidal ideation

(0 = no, 1 = yes). Continuous data are described using medians with interquartile ranges (IQR). Categorical data are presented as frequencies and percentages. To assess the differences between university students with and without suicidal ideation, continuous variables were assessed using two-sample *t*-tests, and categorical variables were assessed using chi-square or Fisher's exact tests, as appropriate. Mann–Whitney *U* tests were performed for non-parametric data. Multivariate covariance analysis was conducted here by selecting suicidal ideation as the dependent variable and considering sex and homeplace as covariates. For logistic regression model construction, students with suicidal ideation were classified as the case group, and those without suicidal ideation were assigned to the control group. All statistical assessments were two-tailed, and the level of significance was set to $P < 0.05$.

3. Results

3.1. Demographic and psychosocial information

A total of 69,790 college students completed the questionnaire survey, of which 25,780 (36.94%) were male students and 44,010 (63.06%) were female students. Furthermore, 29,862 (42.79%) were urban students and 39,928 (57.21%) were rural students. The mean age of students was 19.28 ± 1.36 years, the minimum age was 18 years, and the maximum age was 26 years.

3.2. Prevalence of suicidal ideation and associated psychosocial risk factors

A total of 13.03% (9095/69,790) of the college students reported the presence of suicidal ideation. The demographic characteristics and distribution of the two groups (with and without suicidal ideation) are listed in Table 1. A total of 13.56% of female students reported the presence of suicidal ideation, which was significantly greater than the rate of 12.13% reported in male students ($OR = 0.880, P < 0.0001$). There were 13.37% of students whose families lived in rural areas who reported the presence of suicidal ideation, which significantly greater than the 12.10% of students whose families lived in urban areas ($AOR = 1.161, P < 0.0001$) after the adjusting for sex. Furthermore, compared to those without poor life quality, students with poor life quality had an increased prevalence of suicidal ideation ($AOR = 4.517, P < 0.0001$) after adjusting for sex. Moreover, students with psychological disorder had a significantly increased prevalence of suicidal ideation ($AOR = 8.967, P < 0.0001$) after adjusting for sex. However, there was no significant difference in the incidence of suicidal ideation among students at all ages ($AOR = 1.036, P = 0.3754$). Thus, participants with suicidal ideation were more likely to be female, to come

Table 1
Demographic and psychosocial characteristics of participants with and without suicide ideation ($n = 69,790$).

Variables	Suicide ideation <i>n</i> (%)	No Suicide ideation <i>n</i> (%)	Statistics AOR	(95% CI)	<i>P</i> -value
Gender					
Male	3128 (12.13)	22,652 (87.87)	0.880	(0.841, 0.922)	<0.0001
Female	5967 (13.56)	38,043 (86.44)			
Age					
≤20	8554 (13.02)	57,148 (86.98)	1.036	(0.958, 1.121)	0.3754
21–25	477 (12.87)	3228 (87.13)			
≥26	64 (16.71)	319 (83.29)			
Homeplace					
Rural	5482 (13.37)	34,446 (86.27)	1.161	(1.110, 1.214)	<0.0001
City	3613 (12.10)	26,249 (87.90)			
Quality of life					
Poor	3930 (30.86)	8804 (69.14)	4.517	(4.308, 4.7736)	<0.0001
Good	5165 (9.05)	51,891 (90.95)			
Mental health					
Poor	3021 (48.59)	3196 (51.41)	8.967	(8.475, 9.487)	<0.0001
Good	6074 (9.55)	57,499 (90.45)			

Table 2
The results of multivariate covariance analysis for comparing the personality traits of college students in terms of suicidal ideation, gender and age ($n = 69,790$).

	Personality traits	<i>F</i> -value	<i>P</i> -value
Suicidal ideation	Impulsivity	4303.90	<0.0001
	Aggression	6702.99	<0.0001
	Psychoticism	2952.62	<0.0001
	Extroversion	2301.52	<0.0001
	Neuroticism	11,010.9	<0.0001
Gender	Impulsivity	337.88	<0.0001
	Aggression	117.61	<0.0001
	Psychoticism	1999.05	<0.0001
	Extroversion	110.96	<0.0001
	Neuroticism	732.09	<0.0001
Age	Impulsivity	31.32	<0.0001
	Aggression	34.96	<0.0001
	Psychoticism	45.27	<0.0001
	Extroversion	87.15	<0.0001
	Neuroticism	11.39	0.0007

from rural areas, and to have poor life quality and psychological disorder compared to those without suicidal ideation.

3.3. Relationship between personality traits and suicidal ideation

To investigate the effects of personality traits on suicidal ideation, this study multivariate covariance analysis with suicidal ideation as the dependent variable, with sex and homeplace as covariates. As listed in Table 2, when the group with suicidal ideation was compared to the group without suicidal ideation, the total scores for each of the five personalities were higher among students with suicidal ideation ($P < 0.0001$). Moreover, the results of covariance analysis revealed that the scores for each of the five personality scales show significant differences among different sexes and ages ($P < 0.0001$), as listed in Table 2. Female college students have higher scores for impulsivity, aggression, and neuroticism than male college students, while the scores of female students for psychoticism and extroversion are lower than those of male students.

3.4. Assignment method of independent variables

For the convenience of interpretation during analysis, this study considered the quartile as the cut-off point, corresponding to the low, medium, high, and extreme levels of impulsivity and aggression. T-scores of EPQ scales between 43.3 and 56.7 were considered intermediate types, and those from 38.5 to 43.3 or 56.7 to 61.5 were

Table 3
Assignment method of independent variables in logistic regression model.

Variables	Assignment method
Gender	0 = Female, 1 = Male
Age	0 = < 20, 1 = 21 – 25, 2 > 25
Homeplace	0 = City, 1 = Rural
Quality of life	0 = Good, 1 = Poor
Mental health	0 = Good, 1 = Poor
Impulsivity	0 = < P25 (low), 1 = P25–P75 (medium), 2 = > P75 (high)
Aggression	0 = < P25 (low), 1 = P25–P75 (medium), 2 = > P75 (high)
Psychoticism	0 = < 38.5 (no), 1 = 38.5–43.3 (prone to no psychoticism), 2 = 43.3–56.7 (medium), 3 = 56.7–61.53 (prone to psychoticism), 4 = > 61.53 (psychoticism)
Extroversion	0 = < 38.5 (introversion), 1 = 38.5–43.3 (prone to introversion), 2 = 43.3–56.7 (medium), 3 = 56.7–61.53 (prone to extroversion), 4 = > 61.53 (extroversion)
Neuroticism	0 = < 38.5 (stable mood), 1 = 38.5–43.3 (prone to stable mood), 2 = 43.3–56.7 (medium), 3 = 56.7–61.53 (prone to unstable mood), 4 = > 61.53 (unstable mood)

considered prone types, and T-scores located below 38.5 or above 61.5 were considered typical types. The assignment of independent variables is listed in Table 3.

3.5. Analysis of risk factors for suicidal ideation

To analyze the effects of personality traits on suicidal ideation, the multivariate unconditional logistic regression was conducted by taking suicidal ideation (0 = no, 1 = yes) as the dependent variable and selecting impulsivity, aggression, neuroticism, psychoticism, extroversion, sex, homeplace, quality of life, and mental health as independent variables. A stepwise method was used in multivariate logistic regression analysis (the rejection probability was 0.1). All statistical tests were two-tailed, and the probability of a type I error was 5%. The results of logistic regression analysis are listed in Table 4. The factors associated with suicidal ideation included quality of life (OR = 1.903, 95% CI: 1.803 to 2.010, $P < 0.0001$); mental health (OR = 2.879, 95% CI: 2.438 to 3.398, $P < 0.0001$); impulsiveness (OR = 1.210, 95% CI: 1.160 to 1.261, $P < 0.001$); aggressiveness (OR = 1.552, 95% CI: 1.489 to 1.691, $P < 0.001$); psychoticism (OR = 1.112, 95% CI: 1.083 to 1.141, $P < 0.0001$); extroversion (OR = 0.768, 95% CI: 0.752 to 0.784, $P < 0.0001$); and neuroticism (OR = 1.911, 95% CI: 1.861 to 1.963, $P < 0.0001$). However, sex and homeplace were excluded in the stepwise regression model.

3.6. Evaluation of correlation among personality traits

It was demonstrated that the score for impulsivity, aggression, neuroticism, psychoticism, and extroversion of participants with suicidal ideation are correlated with each other (Table 5). The results suggested that impulsivity was positively correlated with aggression ($r = 0.397$), psychoticism ($r = 0.425$), and neuroticism ($r = 0.371$), but negatively correlated with extroversion ($r = -0.127$). Aggression is positively correlated with impulsivity ($r = 0.397$), psychoticism ($r = 0.380$), and neuroticism ($r = 0.498$). The results also showed that neuroticism has a positive correlation with the other personality traits except for extroversion. Moreover, the results suggested that psychoticism is positively correlated with impulsivity, aggression, and

neuroticism. In particular, extroversion is negatively correlated with the other four personality traits and has no significant correlation with aggression and psychoticism ($P > 0.05$). Extroversion also shows little correlation with impulsivity ($r = -0.127$) and neuroticism ($r = -0.103$).

4. Discussion

4.1. Findings and possible explanations

13.03% of the college students reported the presence of suicidal ideation, which agrees with the latest reporting rate of suicidal ideation from China (12.9%) (Li et al., 2018). The reporting rate of suicidal ideation is also close to the incidence of suicidal ideation reported by Schilling in the United States (16.6%) (Schilling et al., 2009). The present findings indicated that the incidence of suicidal ideation among college students is very high. Although not all college students with suicidal ideation will eventually conduct specific suicidal behaviors, suicidal ideation will increase the risk of suicide among college students. As a vital part of assessing the mental health of college students, the current situation of adolescent suicidal ideation and its causes should be considered.

This study found that the incidence of suicidal ideation among female college students was 13.56%, which was higher than that of male students (12.13%) ($P < 0.05$). Kou Mao-rei (Kou et al., 2018) conducted a meta-analysis on the suicide ideation of Chinese college students and found that the incidence of suicidal ideation of female students was higher than that of male students. The researchers argued that the above findings may have a correlation with girls' emotional richness, delicate minds, sensitivity to external stimuli, and mood swings (Kou et al., 2018). Chinese female college students' learning tasks are relatively heavy, and they often face employment pressure and emotional problems. With these problems, they often feel humiliated, lost, abandoned and even desperate, which can easily lead to suicide. The age of the college students here ranges from 18 to 26 years, and the homogeneity of the participants is strong, which does not reflect the difference because of age. The incidence of suicidal ideation in rural students (13.37%) was higher than that of urban students (12.10%),

Table 4
Logistic regression analysis of risk factors of suicidal ideation.

Factors	B	SE	Wald	P	OR	OR 95% CI
Quality of life	0.6436	0.0277	538.7260	<0.0001	1.903	(1.803, 2.010)
Mental health	1.0573	0.0847	155.9442	<0.0001	2.879	(2.438, 3.398)
Impulsivity	0.1906	0.0213	80.1477	<0.0001	1.210	(1.160, 1.261)
Aggression	0.4398	0.0214	422.4432	<0.0001	1.552	(1.489, 1.619)
Psychoticism	0.1058	0.0133	63.3557	<0.0001	1.112	(1.083, 1.141)
Extroversion	-0.2639	0.0107	609.7443	<0.0001	0.768	(0.752, 0.784)
Neuroticism	0.6478	0.0137	2250.4522	<0.0001	1.911	(1.861, 1.963)

Table 5
The correlation coefficient matrix between each personality traits of participants with suicidal ideation.

	Impulsivity	Aggression	Psychoticism	Extroversion	Neuroticism
Impulsivity	1				
Aggression	0.397*	1			
Psychoticism	0.425*	0.380*	1		
Extroversion	-0.127*	-0.002	-0.019	1	
Neuroticism	0.371*	0.498*	0.325*	-0.103*	1

* Suggests significant difference at level of 0.05.

which agrees with most studies in China (He, 2012). The reason for this result is the unbalanced development of urban and rural, resulting in less social support for rural students.

Considering quality of life as an external risk factor for suicidal ideation, this study found that 18.24% of students had poor life quality, and the incidence of suicide ideation among college students with poor life quality is 30.86%, which is much higher than that of students without poor life quality (9.56%) ($P < 0.01$). Chen et al. have confirmed that the quality of life is related to the suicidal ideation of Chinese college students (Chen et al., 2014). The multivariate logistic analysis in this study confirmed that poor life quality is a risk factor for suicidal ideation among college students (OR = 1.903). This study also found that the poor life quality of college students is mainly reflected in the lack of good social support systems and personal psychological disorder. A study (Kou et al., 2018) suggested that a good social support system can reduce suicidal ideation caused by depression and eating disorders in adolescents. Mental health has a close correlation with suicidal ideation (Wang, 1984). This survey indicated that the incidence of suicidal ideation among college students with psychological disorder reaches up to 48.59%, much higher than that of normal students (9.55%) ($P < 0.01$). Multivariate logistic analysis suggested that psychological disorder was a risk factor for suicidal ideation (OR = 2.879). Students with suicidal ideation, accompanied by varying degrees of depression and anxiety, are significantly more anxious than those without suicidal ideation (Kou et al., 2018). Moreover, the suicidal ideation of college students has a close correlation with their learning, and the tendency to learning anxiety is a significant risk factor for suicidal ideation (Kou et al., 2018).

Personality traits are inherent in individuals, affecting their situations and emotions, decision-making, behavior, and even their suicidal tendencies. According to multivariate covariance analysis, in the overall sample, the scores of impulsiveness, aggressiveness, neuroticism and psychoticism of college students with suicidal ideation are higher than those without suicidal ideation ($P < 0.05$), and the scores of extroversion are lower than those without suicidal ideation ($P < 0.05$). Regardless of sex, scores of college students with suicidal ideation are higher in impulsiveness, aggressiveness, neuroticism, and psychoticism than those without suicidal ideation, while their scores in extroversion are lower than in those without suicidal ideation. These results support the findings of Brezo (Brezo et al., 2006). According to multivariate logistic analysis, more suicidal ideation would occur in the total sample with higher scores in impulsiveness, aggressiveness, neuroticism, and psychoticism, and lower scores in extroversion. This was consistent with the relevant research results (Brezo et al., 2010; Kumar et al., 2013; Peters et al., 2016).

Impulsivity was included in suicide risk factors by the American Suicide Association (Wenzel et al., 2009). Some studies have shown that impulsivity has a close correlation with suicide (Chiho et al., 2012; Erkki, 2014; Glenn and Klonsky, 2010). The multivariate covariance analysis showed that there was a significant difference in impulsivity between different sexes ($P < 0.01$), and female college students were more impulsive. Xia et al. demonstrated that the female college students who committed suicide were more impulsive than male students (Xia et al., 2015). Some studies have found impulsiveness as a risk factor for suicide (Levinson et al., 2007). The multivariate logistic

analysis demonstrated that impulsiveness has positive predictive effects on suicidal ideation (OR = 1.210). Impulsiveness was an important risk factor for action by people with suicidal ideation (Tong et al., 2013), which agrees with the results of this study, suggesting that impulsive personality was closely related to suicide. The correlation analysis in this study verified that aggressiveness and impulsivity are often tightly combined ($r = 0.397$). Brent et al. believe that the close relationship between impulsiveness, aggression, and suicide is attributed to genetic factors (Brent et al., 2003). A study of 5245 college students in Harbin indicated that self-directed aggressive behavior and impulsivity were important predictors of suicidal ideation and attempted suicide (Wang et al., 2014).

Aggression refers to an act that harms other individuals (Buss and Perry, 1992). According to the multivariate covariance analysis, there was a difference in aggression between sexes ($P < 0.01$), and female college students were more aggressive. Xia et al. proved that female college students who attempted suicide were more aggressive than male students (Xia et al., 2015). The multivariate logistic analysis demonstrated that impulsiveness has positive predictive effects on suicidal ideation (OR = 1.552). Exner highlighted that aggression is a vital part of suicide, which is closely related to depression and suicide (Khouri and Greenway, 1996). Aggression is an external manifestation of anger, associated with irritability, impulsiveness, and hostility (Buss and Perry, 1992).

Neuroticism has positive predictive effects on suicidal behavior (Enns et al., 2003; Rozanov and Mid'Ko, 2011). A clinical study has reported that neurotic effects on suicidal ideation may vary with sex, and neuroticism is positively correlated with suicidal ideation only in female patients (Asselt et al., 2004). According to the multivariate covariance analysis, there existed a significant difference in neuroticism between different sexes ($P < 0.01$), and the neurotic tendency was more prominent in female college students. A study suggested that neuroticism only has positive predictive effects on current or recent suicidal ideation (Johnson et al., 2010). The multivariate logistic analysis demonstrated that neuroticism has positive predictive effects on recent suicidal ideation (OR = 1.911). Correlation analysis among personalities showed that neuroticism is positively correlated with impulsivity and aggression, with correlation coefficients of 0.370 and 0.497, respectively, suggesting that students with high neuroticism also show high impulsivity and aggression. A high neuroticism of individuals tends to make them emotionally responsive, responding excessively to stressful events, showing irritability, and ultimately leading to suicidal ideation.

Psychoticism is positively correlated with suicidal ideation (Farmer et al., 2001). According to the multivariate covariance analysis, there was a significant difference in psychoticism between different sexes ($P < 0.01$), and the psychoticism tendency of male college students was more obvious. A study of college students reported that psychoticism played a certain role in promoting suicidal ideation (Lester, 1987; Swahn et al., 2012). The multivariate logistic analysis demonstrated that psychoticism may accelerate the onset of suicidal ideation (OR = 1.112). According to the analysis on the correlation between personalities, psychoticism is positively correlated with impulsiveness and aggressiveness, and the correlation coefficients are 0.425 and 0.380, respectively, suggesting that students with high

psychoticism also show high impulsivity and high aggression. An individual's high mentality tends to distort cognition and negatively affect emotions, leading to severe social isolation, impulsive behavior, and extreme problem solving. This eventually leads to suicidal ideation.

The individuals who attempted suicide had low extroversion scores at all ages (Farmer et al., 2001; Maser et al., 2015). Previous studies on depressive patients and college students have reported a negative correlation between individual extroversion and suicidal ideation (Nader et al., 2013; Segal et al., 2012). The multivariate covariance analysis suggested a significant difference in extroversion between different sexes ($P < 0.01$), and female college students were more introverted. This also explained the higher incidence of suicidal ideation among female college students. The multivariate logistic analysis demonstrated that extroversion has negative predictive effects on suicidal ideation (OR = 0.768). Correlation analysis among personalities suggested that extroversion is negatively correlated with impulsivity and neuroticism, suggesting that introverted personality has an independent effect on suicide. Some researchers have argued that introverted individuals are prone to suicide due to the lack of social support system, which makes social support unable to play a corresponding protective part (Nader et al., 2013; Segal et al., 2012).

4.2. Strengths and limitations

There are certain strengths in this study. First, this study is a large cross-sectional study to investigate quality of life, mental health, different personality traits, and suicidal ideation using a large sample of 69,790 college students in China. Second, it is one of the fewer studies to access and compare the association between five personality traits and suicidal ideation simultaneously. Third, this is one of the fewer studies to assess the correlation among personality traits of college students with suicidal ideation. However, the study also has several limitations. First, this is a cross-sectional epidemiological investigation, which did not identify causal relationships between correlated characteristics and suicidal ideation. Second, there may be memory bias associated with the survey since the questionnaire depends on subjective memory. Third, information bias and limitations of objective measurements related to personality and suicidal ideation may have been present.

4.3. Conclusions

According to this epidemiological survey in Chongqing, China, the prevalence of suicidal ideation among college students was 13.03%. The survey also reported that participants with suicidal ideation were more likely to be female, to come from rural areas, and to have poor life quality and psychological disorder compared with those without suicidal ideation. This study found that students with impulsivity, aggression, neuroticism, psychoticism, and introversion were more likely to have suicidal ideation. Additionally, the impulsivity, aggression, psychoticism, and neuroticism of students with suicidal ideation are positively correlated, and the correlation is significant. However, there exists a negative correlation between extroversion and the other four personalities. These findings suggest that introverted personality plays an independent role in suicidal ideation of college students, while impulsivity, aggression, psychoticism, and neuroticism may be correlated with each other in influencing the occurrence of suicidal ideation.

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Conflict of interest

The authors have no conflicts of interest to declare.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.psychres.2018.12.076](https://doi.org/10.1016/j.psychres.2018.12.076).

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