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The relationship between family functioning and social media addiction among university students: a moderated mediation model of depressive symptoms and peer support

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Abstract

Background Social media addiction (SMA) is an increasing problem, especially among young adults. Little is known about university students' SMA and family functioning. This study aimed to explore the mediating effect of depressive symptoms and the moderating effect of peer support in the relationship between family functioning and SMA among young adults.

Methods A sample of 1862 Chinese university students completed an online survey including the Bergen Social Media Addiction Scale (BSMAS), Family APGAR, the Patient Health Questionnaire (PHQ-9), peer support, and demographic characteristics. Hierarchical regression and moderated mediation analysis were used to test the effects and pathways among them.

Results Of the 1840 participants, 30.11% experienced SMA, 38.80% had family dysfunction and 15.98% had depressive symptoms. Hierarchical multiple regression showed better family functioning significantly predicted less SMA ($\beta = -0.26, p < 0.001$) and lower depressive symptoms ($\beta = -0.58, p < 0.001$), after adjusting for covariates. Mediation analysis verified that depressive symptoms mediated the effect of family functioning on SMA (indirect effect = $-0.22, 95\%CI[-0.28, -0.17]$). Furthermore, the interaction of family functioning and peer support was negatively related to depressive symptoms ($\beta = -0.03, 95\%CI[-0.05, -0.01]$) and the interaction of depressive symptoms and peer support was positively related to SMA ($\beta = 0.01, 95\%CI[0.004, 0.02]$). Additional analysis further confirmed that peer support decreased depressive symptoms among young adults from dysfunctional families, and increased SMA behaviors in individuals with depressive symptoms.

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Conclusion Better family functioning and lower depressive symptoms may contribute to less social media addiction among Chinese university students. Peer support could moderate the mediating role of depressive symptoms on social media addiction in individuals with family dysfunction.

Keywords Social media addiction, Family functioning, Peer support, Depressive symptoms, University students

Introduction

Social media, with its great popularity and strong functioning, has become an indispensable aspect of daily life [1]. According to the 51st Statistical Report on Internet Development in China [2], 32.9% of Internet users were adolescents and youth under 30 years of age. A national survey among 5118 college students revealed that 99.39% of them use social media and spend more than 4 h on social media daily in China [3]. As social media usage increases, it may give rise to negative outcomes [4], such as overreliance and addictive behavior [5] on social media among young adults.

Social media addiction (SMA), defined as prolonged exposure to and repeated use of social media [6], is characterized by a dysfunctional form of being unable to resist the motivation to follow social media, and experiencing distress if prohibited from using social media [7]. A meta-analysis of 64 countries demonstrated that the pooled prevalence rate of SMA was 17.42% in the general population [8]. In China, 15.2% of university students have SMA [9]. Current evidence derived from cross-sectional studies and meta-analyses demonstrated that SMA may be related to negative consequences, like poor academic performance [10], sleep disorders [11], worse psychological well-being [12], and so on [13]. Therefore, SMA may be a more noteworthy public health concern, and it is vital to explore the risk factors and potential mechanisms of SMA.

Ecological system theory [14] emphasizes that the interaction between individual characteristics and ecological systems (e.g., family and society) shapes the developmental outcomes of individuals. Although ecological system theory and existing studies [15, 16] have indicated

that the formation of SMA is strongly affected by the structures and interactions of various systems, few studies have examined the interactive effects of family functioning, peer support, and depressive symptoms on SMA among Chinese university students.

Family functioning and SMA

According to the McMaster Family Functioning Model Theory, family functioning refers to providing an appropriate environment and promoting the growth and development of family members, including physical, psychological, social, and other domains [17]. Previous studies have suggested that good family functioning involving adaptation, interaction, cohesion, closeness, response, and problem-solving [18] between family members is essential for lowering the likelihood of psychological distress [19] and problematic behavior [20]. For example, a longitudinal study involving 3 waves of follow-up in Hong Kong among 3325 junior high school students revealed that good family functioning was related to less SMA [21]. Family dysfunction (e.g., poor relationships and intense conflict) was identified to be associated with increased SMA significantly [22]. However, another recent longitudinal study among 1344 middle school students found that family functioning was not related to addiction to social media [23]. In this afore-mentioned study, SMA was measured by one single item “how much time spent on social media”; which evaluated one aspect of SMA, resulting in oversimplified and controversial findings. Thus, no consensus has been reached regarding the relationship between family functioning and SMA. Furthermore, studies on the relationship between family functioning and SMA have mainly focused on children

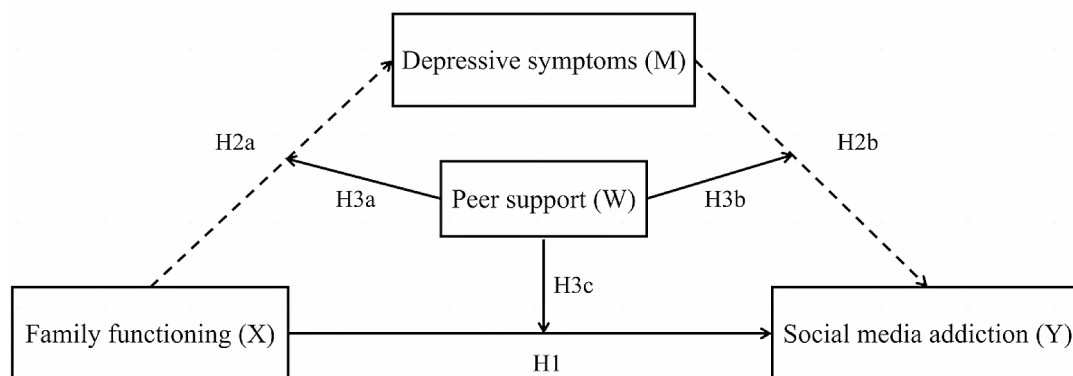


Fig. 1 Hypothesized moderated mediation model

and adolescents, while few studies have been conducted on university students in China. Therefore, the relationship between family functioning and SMA among Chinese university students needs to be studied further.

Depressive symptoms as a mediator

Depressive symptoms, as the main factor contributing to the worldwide burden of disease, have a prevalence rate of 33.60% among Chinese university students [24]. On the one hand, depressive symptoms were reported to be directly related to problematic behaviors, including e-cigarette use [24] and problematic smartphone use [25]. A meta-analysis of 50 studies with 27,935 participants concluded that there was a positive correlation between depressive symptoms and SMA [26]. Another study involving 8,912 university students from seven countries highlighted that depressive symptoms were positively related to SMA [27]. On the other hand, previous research suggested that family functioning was a predictor of depressive symptoms [28]. Good family functioning facilitates the fulfillment of individuals' relatedness needs [29] and subsequently enhances physical and mental well-being [30]. A birth cohort over 3 decades demonstrated that family conflict played a key role in increasing adolescent depressive symptoms. According to compensatory Internet use theory [31], people may resort to social media as a coping strategy to make up for unsatisfied offline psychological needs and alleviate negative emotions (e.g., depressive symptoms) during challenging real-life situations (e.g., family dysfunction) [32]. Overall, considering the above theoretical and empirical evidence, good family functioning may decrease individuals' depressive symptoms and social media addiction. And depressive symptoms were positively related to SMA [33]. Therefore, we hypothesized that depressive symptoms may mediate the association between family functioning and SMA.

Peer support as a moderator

Peer support, referring to mutual assistance, empathy exchange, and receiving companionship from peers [34], may improve individuals' psychological state [35] and problematic behavior [36] (e.g., SMA [36, 37]). Nevertheless, when social media is considered an expansion of social connections to maintain peer relationships and seek peer assistance, peer support may become a trigger for SMA [38]. In line with a systematic review, peer support had a positive impact on SMA [39]. Thus, the relationship between peer support and SMA should be further explored.

In addition, many studies have shown that peer support plays an important protective role in the associations among life events, mental disorders, and addictive behavior. According to the stress-buffering model, the

interaction between positive experience and peer support has the potential to counter the negative effects of stress [40], promote mental health [41], and reduce addictive behavior [42]. For instance, a longitudinal study conducted on 1301 middle school students emphasized that peer support may buffer the effect of family functioning on adolescent depressive symptoms [43]. However, a recent two-year longitudinal study pointed out that higher levels of peer support exacerbated depressive symptoms in adolescents who experienced family violence [44]. Another cross-sectional study conducted on 1258 participants aged 13 to 24 years indicated that better peer support may increase the risk of SMA in individuals suffering from negative emotions [45], indicating that peer support may reinforce the effects of negative events. Based on the afore-mentioned studies, the moderating effect of peer support on the relationships among family functioning, depressive symptoms, and SMA deserves further exploration.

The present study

Taken together, family functioning, depressive symptoms, and peer support may be correlated to SMA, but there are still some controversial results for the possible mechanisms underlying these associations among Chinese university students. Hence, the current study developed a moderated mediation model (see Fig. 1) to elucidate the pathway from family functioning to SMA by analyzing the mediating effect of depressive symptoms and the moderating effect of peer support on this association among Chinese university students. The following hypotheses were formulated:

H1 Good family functioning may be negatively associated with SMA among university students in China.

H2 Depressive symptoms may mediate the relationship between family functioning and SMA.

H3 Peer support might function as a moderator of the direct effect (H3c: family functioning-SMA) and/ or indirect effect (H3a: family functioning-depressive symptoms; H3b: depressive symptoms-SMA) of family functioning on SMA.

Methods

Procedures and participants

The current study was conducted at Nantong University, a comprehensive school in Jiangsu Province in eastern China, from April to May 2020. We used cluster sampling to randomly select two majors from three major categories (science and technology, liberal arts, and medicine) and then selected five classes from freshmen to seniors and above in each major. 12 Counselors from six majors,

who provided guidance, counseling, and advocacy services for these young adults at Nantong University, were recruited as investigators and informed about the general aim of the research and the procedure of data collection. A total of 1862 university students completed the questionnaire through an online survey platform “Questionnaire Star” (<https://www.wjx.cn>).

The inclusion criteria of participants were as follows: (1) full-time university students aged 18 to 25; (2) could use social media daily, including WeChat, Weibo, Facebook, and so on. The exclusion criteria included (1) less than 18 years old; (2) suffering from mental illness; (3) having visual disorders. The respondents were also told the aim of the study and provided informed consent electronically. Participants giving none or partial responses were deleted from the data set, and 1840 valid samples were analyzed, for an effective response of 98.82%.

Measures

Predictor variable

Family functioning was measured using the Family Affection Partnership Growth Adaptation Resolve Scale [46], which uses a 3-point Likert scale to score each item from 0 (nearly none) to 2 (almost always). The responses of the five items were summed to generate a total score, with a higher score indicating better family functioning. A total score below 4 reflects a very dysfunctional family, a score between 4 and 6 reflects a moderately dysfunctional family and a score ranging from 7 to 10 reflects a well-functioning family [47]. The internal consistency

dependability of this study was high with a Cronbach’s alpha coefficient of 0.903.

Mediating variable

The severity of depressive symptoms was examined using the Patient Health Questionnaire (PHQ-9) [48], which measures the extent of depressive symptoms on a 4-point Likert scale ranging from 0 (not at all) to 3 (more than a week). The sum of the scores ranged from 0 to 27, and individuals who scored ≥ 10 points were classified as suffering from depressive symptoms [49]. The Cronbach’s alpha coefficient obtained was 0.929.

Moderating variable

Peer support was evaluated using six items from the Healthy Lifestyle Scale for University Students (HLSUS) [50], which is a self-administered instrument that consists of 8 dimensions, and each item was evaluated using a 5-point Likert scale ranging from 1 to 5, with a higher total score signifying a higher level of peer support. The Cronbach’s alpha coefficient was 0.924.

Dependent variable

The SMA was evaluated by the Bergen Social Media Addiction Scale (BSMAS) [51], which measures salience, emotion regulation, tolerance, withdrawal, conflict, and relapse, with scores ranging from 1 to 5. The cumulative score is determined by summing the scores of the six items, spanning a range of 6 to 30. Individuals with a score of 19 or higher [52] were considered to have SMA. The Bergen Social Media Addiction Scale has been widely applied in Chinese university students and has great psychometric properties with high internal consistency (Cronbach’s $\alpha=0.85$), criterion, and construct validity [53]. The Cronbach’s alpha in the current study was 0.889.

Covariates

Covariates including age [54], gender [55], grade [56], and major [57] were obtained from participants and included in the analysis, as these variables were identified to be related to SMA in the previous studies. Gender is a dummy variable that equals 1 for males and 2 for females. The grade level was a categorical variable: 1=freshmen, 2=sophomores, 3=juniors, and 4=seniors and above. Major is a dummy variable: 1 for medical majors, including public health and preventive medicine, and clinical medicine, and 2 for other majors.

Statistical analyses

All the statistical analyses were carried out using SPSS 27.0 and PROCESS macro. First, descriptive analyses were performed to characterize the sample (see Table 1). Second, partial correlation analysis was performed to

Table 1 Basic characteristics of university students (n = 1840)

Variables		N(%)	Social media addiction
Gender	Male	535(29.08)	148(27.66)
	Females	1305(70.92)	406(31.11)
Grade	Freshmen	535(29.08)	143(26.73)
	Juniors	355(19.51)	88(24.51)
	Sophomores	659(35.82)	225(34.14)
	Seniors and above	287(15.59)	98(34.15)
Major	Medical field	1134(61.63)	339(29.89)
	Other fields	706(38.37)	215(30.45)
Only Child	Yes	994(54.02)	293(29.48)
	No	846(45.98)	261(30.85)
Family functioning (APGAR score)	dysfunctional	93(5.05)	44(47.31)
	moderately dysfunctional	621(33.75)	209(33.66)
	well-function	1126(61.20)	301(26.73)
Depressive symptoms (PHQ-9 score)	None	1546(84.02)	377(24.39)
	Moderate and severe	294(15.98)	177(60.20)
Total		1840(100)	554(30.11)

Table 2 Partial correlations among predictor, mediator, moderator, and dependent variables

Variables	Mean ± SD	1	2	3	4
1 Family functioning	7.52 ± 2.48	1			
2 Depressive symptoms	5.51 ± 5.39	-0.27***	1		
3 Social media addiction	16.73 ± 5.22	-0.12***	0.40***	1	
4 Peer support	22.83 ± 4.90	0.36***	-0.16***	-0.02	1

Note The variables of age, gender, grade, and major were controlled. ****p*<0.001

Table 3 Mediation models of family functioning on social media addiction through depressive symptoms

Variables	Model 1 (Social media addiction)			Model 2 (Depressive symptoms)			Model 3 (Social media addiction)		
	β	t	95%CI	β	t	95%CI	β	t	95%CI
Predictor									
Family functioning	-0.26***	-5.18	-0.35, -0.16	-0.58***	-11.75	-0.67, -0.48	-0.04	-0.74	-0.13, 0.06
Mediator									
Depressive symptoms							0.38***	17.45	0.34, 0.43
Covariates									
Age	0.13	0.83	-0.18, 0.44	-0.23	-1.45	-0.53, 0.08	0.22	1.50	-0.07, 0.50
Gender	0.33	1.23	-0.20, 0.86	-0.93**	-3.45	-1.45, -0.40	0.69**	2.74	0.20, 1.18
Grade	-0.01	-0.06	-0.36, 0.34	0.28	1.58	-0.07, 0.62	-0.12	-0.71	-0.44, 0.20
Major	0.10	1.01	-0.10, 0.31	0.01	0.13	-0.19, 0.21	0.10	1.04	-0.09, 0.29
Adj-R ²	0.01			0.08			0.16		
F	6.32***			31.31***			56.87***		

Note *N*=1840; The variables of age, gender, grade, and major were controlled. 95% CI=Bootstrap confidence intervals with lower and upper limits. **p*<0.05, ***p*<0.01, ****p*<0.001

Table 4 Bootstrap test of the mediating effects of depressive symptoms

Effect	β	SE	LLCI	ULCI
Total effects	-0.26	0.05	-0.35	-0.16
Direct effect	-0.04	0.05	-0.13	0.06
Total indirect effect	-0.22	0.03	-0.28	-0.17

Note *N*=1840. The variables of age, gender, grade, and major were controlled. LLCI represents a lower level of the confidence interval, and ULCI represents the upper level of the confidence interval

test how these variables were related after adjusting for control variables (see Table 2). Third, hierarchical multiple regressions were utilized to examine the mediating impact of depressive symptoms (Table 3). Model 1 tested the connection between family functioning (X) and SMA (Y) (H1). Model 2 tested the connection between family functioning (X) and depressive symptoms (M) (H2). Model 3 examined the direct effect of family functioning (X) and depressive symptoms (M) on the SMA (Y). Model 1 and Model 3 provided direct and indirect paths among these variables (see Table 3). Furthermore, Model 4 of the PROCESS was used to analyze the mediating effect of depressive symptoms (see Table 4) on the relationship between family functioning (X) and SMA (Y).

Model 59 of the PROCESS was utilized to examine the moderating effects of peer support (see Table 5; Fig. 2) between family functioning (X) and SMA (Y). Model 4a examined the direct moderating effect of peer support on the relationship between family functioning (X) and SMA (Y). Model 4b examined the indirect moderating effect of peer support on the relationship between family

functioning (X) and the SMA (Y) via depressive symptoms (M). Basic slope tests were performed to determine the moderating effects of peer support (see Fig. 3). The PROCESS macro provided 95% confidence intervals (CIs) for the Model 59 effect based on 5000 bootstrapped samples. When the 95% CI of the interaction did not contain zero, a significant moderated mediation effect could be established with certainty.

Common method bias

Common method bias (CMB) could exist when the data are obtained via self-reports. Therefore, the procedure was arranged carefully, and the respondents completed the questionnaire anonymously. Harman’s single-factor test was applied to avoid CMB. The analysis revealed that there were 22 factors with Eigenvalues above 1. The first component explained 14.22% of the variance, which was below the required threshold of 40% [58], indicating that there was no substantial evidence of CMB.

Table 5 Moderated mediation regressions of family functioning, peer support, depressive symptoms, and social media addiction

Variables	Model 4a (Depressive symptoms)					Model 4b (Social media addiction)				
	β	SE	t	LLCI	ULCI	β	SE	t	LLCI	ULCI
Family functioning	-0.55	0.05	-10.34	-0.66	-0.45	-0.07	0.05	-1.28	-0.17	0.04
Depressive symptoms	-	-	-	-	-	0.38	0.02	17.33	0.34	0.43
Peer support	-0.07	0.03	-2.51	-0.12	-0.02	0.06	0.03	2.23	0.01	0.11
Family functioning × peer support	-0.03	0.01	-3.14	-0.05	-0.01	0.01	0.01	0.74	-0.01	0.03
Depressive symptoms × peer support	-	-	-	-	-	0.01	0.004	3.03	0.004	0.02
Age	-0.23	0.16	-1.46	-0.53	-0.08	0.21	0.15	1.42	-0.08	0.49
Gender	-0.87	0.27	-3.24	-1.40	-0.34	0.61	0.25	2.42	0.12	1.10
Grade	0.25	0.18	1.45	-0.09	0.60	-1.00	0.16	-0.59	-0.42	0.22
Major	0.02	0.10	0.22	-0.18	0.22	0.09	0.10	0.98	-0.09	0.28
Constant	5.70	3.01	1.89	-0.20	11.61	11.35	2.81	4.04	5.83	16.86
Adj-R ²	0.089					0.166				
F	25.122					39.815				

Note N = 1840. The variables of age, gender, grade, and major were controlled. Abbreviation: LLCI: a lower level

Results

Participant characteristics

The descriptive statistics for the variables are displayed in Table 1. Among the 1840 participants, the average age was 20.88 years. There were 535 males (29.08%) and 706 medical students (38.37%) (see Table 1). There were 535 freshmen (29.08%), 359 sophomores (19.51%), and 659 juniors (35.82%). A total of 994 participants were only children. A total of 30.11% had SMA (BSMAS score ≥ 19), 38.80% had a dysfunctional family (APGAR score < 7), and 15.98% had depressive symptoms (PHQ-9 score ≥ 10).

Correlation analysis of family functioning, depressive symptoms, peer support, and SMA

Partial correlation analysis was conducted for family functioning, depressive symptoms, peer support, and SMA (see Table 2), and demographic factors, including age, gender, grade, and major, were included as control variables. Good family functioning was negatively correlated with depressive symptoms ($r = -0.27$, $p < 0.001$) and SMA ($r = -0.12$, $p < 0.001$). Depressive symptoms were positively correlated with SMA ($r = 0.40$, $p < 0.001$). Peer support had a positive correlation with family functioning ($r = 0.36$, $p < 0.001$) and a negative correlation with depressive symptoms ($r = -0.16$, $p < 0.001$).

Depressive symptoms as a mediator

Hierarchical multiple regressions were utilized to examine whether depressive symptoms acted as a mediator in the relationship between family functioning and SMA, and the results are shown in Table 3. After adding the control variables, family functioning was negatively related to SMA ($\beta = -0.26$, 95% CI [-0.35, -0.16]) (see Model 1), supporting Hypothesis 1. After the mediating variable was included, better family functioning negatively predicted depressive symptoms ($\beta = -0.58$, 95%CI

[-0.67, -0.48]) (see Model 2). Depressive symptoms positively predicted SMA ($\beta = 0.38$, 95%CI[0.34, 0.43]). However, the direct effect of family functioning on SMA was not significant (see Model 3), suggesting that depressive symptoms may fully mediate this relationship. Moreover, Model 4 of the PROCESS macro confirmed that the mediating effect was significant (indirect effect = -0.22, 95%CI [-0.28, -0.17]), suggesting that depressive symptoms mediated this connection (see Table 4), and Hypothesis 2 was confirmed.

Peer support as a moderator

The results of the moderated mediation regression analysis are displayed in Table 5; Fig. 2. Model 4a showed that the interaction between family functioning and peer support was negatively related to depressive symptoms ($\beta = -0.03$, 95% CI [-0.05, -0.01]), indicating that peer support may attenuate the relationship between family functioning and depressive symptoms, supporting Hypothesis 3a. Model 4b showed that the interaction effect of depressive symptoms and peer support was positively related to SMA ($\beta = 0.01$, 95%CI[0.004, 0.02]), indicating that peer support exacerbated the positive effect of depressive symptoms on SMA, supporting Hypothesis 3b. Furthermore, the interaction of family functioning and peer support failed to predict SMA ($\beta = 0.01$, 95%CI[-0.01, 0.03]), suggesting that peer support did not play a moderating role in the direct relationship between family functioning and SMA, and Hypothesis 3c was rejected.

Finally, simple slope tests were carried out to indirectly determine the moderating effects of peer support on the relationship between family functioning and SMA. Figure 3a showed the conditional direct effects of family functioning (X) on depressive symptoms (M) at different moderator levels, where there was a stronger effect for individuals with higher levels of peer support than for

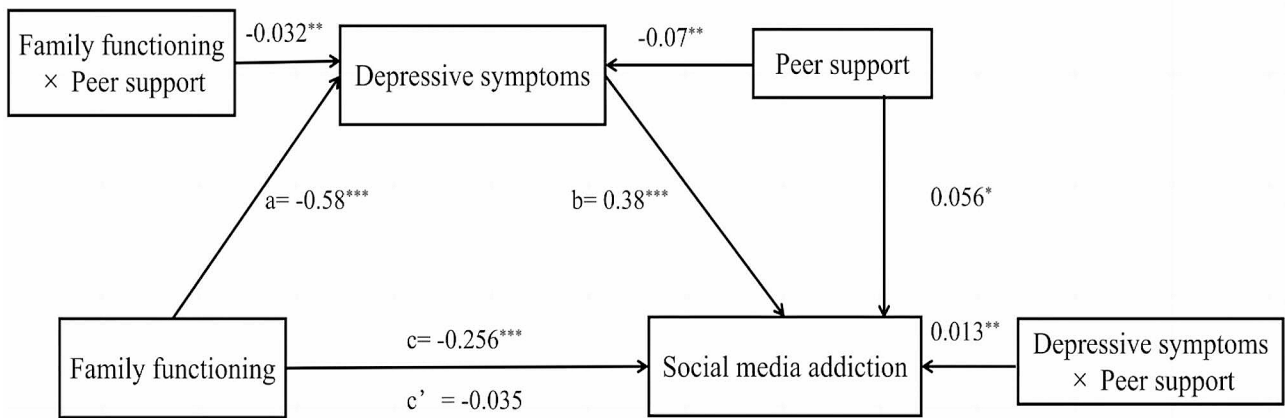


Fig. 2 Moderated Mediation effect model. Note N= 1840. The variables of age, gender, grade, and major were controlled a, b, c, and c' are regression coefficients. c = total effect of family functioning on SMA; c' = direct effect of family functioning on SMA. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

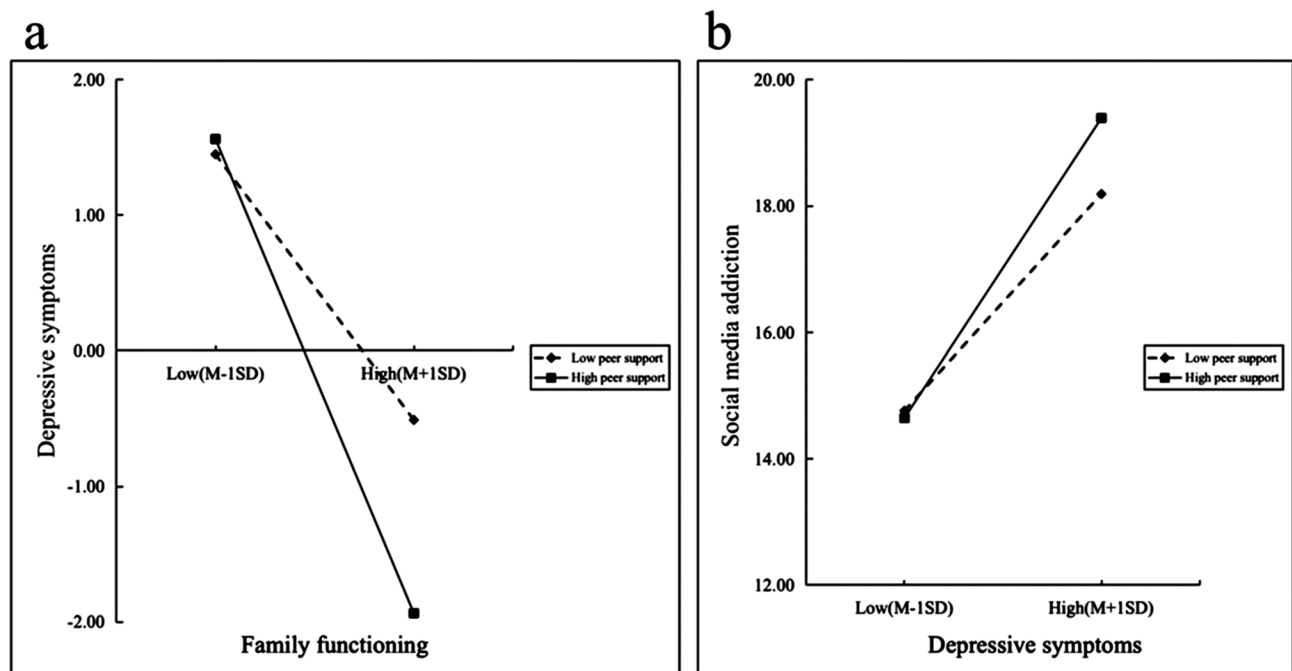


Fig. 3 (a) The moderating effect of peer support on the relationship between family functioning and depressive symptoms.(b) The moderating effect of peer support on the relationship between depressive symptoms and social media addiction. Note N=1840. The variables of age, gender, grade, and major were controlled.

those with lower levels of peer support. It can be inferred from the plots that, with a higher level of peer support and better family functioning, there was an attenuating effect on depressive symptoms. Furthermore, as illustrated in Fig. 3b, there was a stronger effect in the higher level of peer support than the lower-level peer support, and it can be inferred that with a higher level of peer support and more severe depressive symptoms, there was an enhanced effect on SMA.

Additional analysis

To verify our findings for the moderating effect of peer support, we conducted two regression tests by splitting the sample. First, to test the moderating effect of peer support on the relationship between family functioning and depressive symptoms, we divided the sample into two subsamples using the cutoff score of PHQ-9 [49] to categorize the participants into two groups, including depressive symptoms and non-depressive symptoms groups. The result showed that the relationship between peer support and depressive symptoms was not significant for university students with good family functioning

($\beta = -0.032$, $p > 0.05$), but was significantly negative for those with dysfunctional family functioning ($\beta = -0.138$, $p < 0.001$), indicating that peer support could decrease depressive symptoms among university students from dysfunctional families and verifying Hypothesis 3a.

Similarly, we divided the sample into two subsamples using the BSMAS cutoff score [52] to categorize the two groups by testing the moderating role of peer support on the relationship between depressive symptoms and SMA. The results showed that the relationship between peer support and SMA was significantly positive ($\beta = 0.274$, $p < 0.001$) for university students with depressive symptoms but was not significant for university students without depressive symptoms ($\beta = -0.038$, $p > 0.05$). To sum up, the results are consistent with those of our main analysis, indicating that peer support could increase SMA among university students with depressive symptoms and verifying Hypothesis 3b. The results from additional regression tests are presented in Supplementary Tables 1 and Table 2.

Discussion

The main contribution of our study was to explore how depressive symptoms and peer support influence the relationship between family functioning and social media addiction among Chinese university students. According to the conceptual model, our study employed a moderated mediation analysis to reveal three findings. First, good family functioning was significantly related to lower social media addiction. Second, depressive symptoms may function as a mediator in the relationship between family functioning and SMA. Third, the indirect effect of the mediation model was moderated by peer support, as peer support decreased depressive symptoms when family functioning was lower and aggravated social media addiction when university students suffered from depressive symptoms. The results help to elucidate the risk factors and underlying mechanisms of SMA among Chinese university students and provide valuable insight into how family functioning and peer support protect against depressive symptoms and SMA.

Family functioning and SMA

Our study has confirmed that university students with good family functioning are less likely to suffer from SMA, which aligns with existing studies that have demonstrated the relationship between family functioning and individual development [59]. Additionally, the current findings provided empirical support for the McMaster Family Functioning Model Theory [17] and highlighted the effect of better family functioning on the psychological and behavioral performance of Chinese university students. Good family functioning, including adequate affective communication, may give individuals a

vent for negative emotions and prevent them from over-sharing or becoming overly dependent on social media [60]. Furthermore, high propinquity interaction between family members, for instance, effective in-person communication, is likely to convey affection and foster family closeness [61], which then contributes to less SMA [23]. Consequently, the criticality of good family functioning in the advancement of university students is brought to light.

The mediating role of depressive symptoms

Our study also highlighted the mediation effect of depressive symptoms on the relationship between family functioning and SMA. This finding provided evidence for understanding the potential mechanisms underlying the relationship between good family functioning and problematic behavior, which is consistent with prior findings [62]. Better family functioning could be beneficial to superior psychological states and behavioral outcomes [63]. In addition, our findings revealed that depressive symptoms have a positive impact on SMA, in line with studies showing that university students with depressive symptoms are more vulnerable to having SMA [64], supporting the model of compensatory internet use [31]. As such, those who find it difficult to receive comfort from family members are susceptible to suffering from depressive symptoms and may seek insufficient care via social media as a kind of compensation [65]. This study is one of the first to employ such a theory within the family realm by revealing that university students with good family functioning may be conducive to optimizing psychological conditions and improving undesirable behavior.

The moderating effects of peer support

The most important findings were that peer support had moderated effects on the relationships between family functioning and SMA through depressive symptoms.

On the one hand, peer support could alleviate the relationship between family functioning and depressive symptoms, which was consistent with previous findings that peer support was protective for mental health, especially for individuals lacking support from family members [66]. Our findings highlighted the primary effect model of social support, which posited that peer support may foster the cultivation of favorable psychological attributes and beneficial behavioral patterns [67]. One potential explanation might be that the unfulfilled emotional requirements from the family environment could be slightly compensated for by the relatively higher levels of peer support. Greater family functioning along with a greater level of peer support might enhance the acceptance and understanding of individuals, thus buffering pressure, and improving psychological conditions [68]. Therefore, this study sheds light on the protective role of

peer support in relieving negative emotions when family-related factors are at extremely low levels for Chinese university students.

Furthermore, peer support may increase the likelihood of SMA for university students with depressive symptoms, in line with recent findings [45]. According to the compensatory satisfaction theory, appropriate and effective communication is necessary to achieve adequate and timely psychological satisfaction [69]. Owing to the benefits of broadening social networks and furnishing individuals with a platform that enables convenient sharing and communication via social media [70], university students may interact with others online. Consequently, university students who are experiencing depressive symptoms could seek interpersonal interactions by accessing social media, thereby alleviating negative emotions, and attaining satisfaction [71], making them prone to further over-indulge in social media and then being addicted to social media.

Limitations

The limitations of the current study should also be acknowledged. We employed a cross-sectional methodology to discover the relationships between family functioning, peer support, depressive symptoms, and SMA. Although a moderated mediation analysis can predict this association, we could not determine causality. A longitudinal design should be adopted to explore the effect of family functioning on SMA over time in the future. Second, the scope of our study was constrained due to its exclusive execution at Nantong University. In the future, studies should enlarge the sample size and increase the scope of coverage. Third, the survey was based on self-reports. To enhance the accuracy of the results, future research should incorporate unbiased metrics, such as interviews, to obtain objective measures.

This research puts forward several propositions for future studies. First, to verify and examine our model, future studies can explore specific social media addiction (e.g., Facebook [72], YouTube [73]) in our proposed model; In addition, the relationships between family functioning, peer support, depressive symptoms and other types of Internet addiction may also be explored, including gaming and mobile phone addiction; Finally, different types of internet addiction can be assessed using a psychometric sound instrument (e.g., Assessment of Criteria for Specific Internet Use Disorders (ACSID 11) [74].

Implications

The current study presents a comprehensive framework to clarify the connections between family factors, peer support, psychological factors, and behavioral outcomes. This provides implications for how family functioning

and SMA influence depressive symptoms and SMA both theoretically and empirically. Therefore, parents should be more concerned about psychological well-being and problematic behavior by maintaining open lines of communication and exchanging with steady emotional attachment. University staffs should be aware of students' mental health status and intervene in peer relationships, such as by launching a psychological counseling platform, regularly assessing mental health, and organizing interactive activities.

Conclusion

To sum up, this study made contributions to the existing research by pinpointing the mediating and moderating factors that establish a connection between family functioning to SMA among Chinese university students. Overall, good family functioning could be related to better mental health and decreased SMA. In addition, a greater level of peer support could decrease individuals' depressive symptoms when their family functioning is lower and peer support may increase their SMA behaviors with depressive symptoms among Chinese university students. Improving the psychological states and behavioral development of Chinese university students could be prioritized to emphasize the importance of enhancing family functioning and cultivating positive peer support properly.

Abbreviations

SMA Social Media Addiction

Supplementary Information

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Supplementary Material 1

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Author contributions

(I) Conception and design: Yating Qi, Miaomiao Zhao, Yuexia Gao, Yaqin Zhong; (II) Administrative support: none; (III) Provision of study materials: Yating Qi, Miaomiao Zhao, Tingting Geng, Luyao Niu; (IV) Collection and assembly of data: Yating Qi, Miaomiao Zhao, Ziqi Tu, Qingyun Lu, Ruyu Li, Luyao Niu; (V) Data analysis and interpretation: Yating Qi, Wenjie Qu; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors. All authors contributed to and have approved the final manuscript.

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Data availability

The data in this paper are from a questionnaire survey. The data may be accessed after obtaining the author's consent (email:yxgao@ntu.edu.cn).

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Nantong University. All respondents were aware of the purpose of this study and consented to participate in the survey. Informed consent was obtained from all participants involved in the study. Data were collected anonymously. This study was performed in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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