

Social Anxiety May Modify the Relationship Between Internet Addiction and Its Determining Factors in Chinese Adolescents

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Published online: 4 June 2018

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Abstract The aim of this study was to explore Internet addiction (IA) and its associated factors among Chinese adolescents. Ten thousand one hundred fifty-eight Chinese adolescents were selected in this study by using random cluster sampling. The prevalence rate of IA among Chinese adolescents was 10.4%. Multivariate logistic regression analyses showed gender, the only child, father-adolescent relationship, annual family income, academic performance, physical exercise, Rosenberg Self-esteem Scale (RSES) score, and Liebowitz Social Anxiety Scale (LSAS) score were significantly associated with IA among adolescents in social anxiety group ($P < 0.05$). In addition, gender, parental control, annual family income, academic performance, physical exercise, RSES score, and LSAS score were significantly associated with Internet addiction among adolescents in non-social anxiety group ($P < 0.05$). The mediating effects of social anxiety between multiple factors and IA were also significant. These findings can provide guidance aimed at reducing IA among Chinese adolescents.

Keywords Adolescents · China · Internet addition · Social anxiety · Associated factors

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The emergence of the Internet has largely changed people's modern life. It can help people quickly search the information, promote information sharing, and provide a new way of communication between people. However, as the rapidly increased and uncontrolled use of the Internet, Internet addiction (IA) has become a significant public health problem in the world, especially among adolescents (Festl et al. 2013). At present, it is estimated that 1.5–8.2% of the general population are addicted to the Internet in Europe and the USA (Mohammadbeigi et al. 2016; Weinstein and Lejoyeux 2010). In Asia, the prevalence of IA in adolescents was reported to be 10.7% in Korea (Lee and McKenzie 2015), 15.3% in Taiwan (Lin et al. 2011), and 6.4% in China (Ni et al. 2009).

Currently, official diagnostic criteria about IA do not exist, but Young (1999) defined IA as excessive, compulsive, uncontrollable, tolerance-causing Internet use, which causes distress and serious results in social problems. IA has following types: cyber-sexual addiction, cyber-relationship addiction, net compulsions, information overload, and computer addiction (Griffiths et al. 2016).

In order to develop effective strategies for prevention and intervention of IA among adolescents, until now, a number of studies have been conducted to analyze the influential factors of IA. Tsitsika et al. (2011) indicated that males are more likely to be addicted to the Internet than females. Karacic and Oreskovic (2017) revealed that there is a strong correlation between quality of life and the level of their Internet addiction. Chinese researchers Yang et al. (2017) reported that regional contextual determinants, especially air pollution, can affect IA among college students in China. Recently, more and more studies have explored the effects of psychological interventions on IA. Two meta-analyses evaluated the effects of intervention treatment for IA, which found psychological intervention was a useful treatment for reducing IA (Yeun and Han 2016; Winkler et al. 2013). Nowadays, social anxiety is a common psychological disorder among adolescents. Therefore, the impact of social anxiety on IA in adolescents cannot be ignored.

Social anxiety or social phobia refers to excessive and persistent fear of social or performance situations and tends to be followed by phobic avoidance behavior (Slade and Andrews 2001). The onset of social phobia is typically in late childhood or early adolescence (Mancini et al. 2005). It is a common psychiatric disorder in children and adolescents that can cause major social and health problems (American Psychiatric Association 2000), including poor school performance, job loss, difficulties in social skills and peer relationships, concurrent mood disorder, and impairment in family life (Morris 2001; Sarosh et al. 2007). Adolescents who suffered from social anxiety caused by face-to-face interaction may still desire to connect and communicate with others (Gultekin and Dereboy 2011). The non-face-to-face online communication may be a better choice and lower risk way (Huan et al. 2014; Campbell et al. 2006). The Internet could help develop a "virtual world" (Allison et al. 2006) to leave the real world off, which adolescents can hide and escape from social difficulty in the real world. In addition, the Internet could offer social support (Shepherd and Edelman 2005). Thus, adolescents with social anxiety use the Internet to relieve their social anxiety symptoms. However, if adolescents with social anxiety are not well treated, they will spend more and more time to the Internet (Yen et al. 2007a), and the motivation to interact with others in the real world decreases (Ko et al. 2012). The vicious cycle may lead to IA, and the social anxiety becomes more severe. Thus, adolescents who experienced social anxiety were prone to IA, and adolescents addicted to the Internet could increase the severity of social anxiety.

The effects of predisposing factors on IA in adolescents exhibiting different levels of social anxiety are even less studied. If the influences of specific factors on IA depend on the social

anxiety, then we may see dissimilar relationships of IA with these factors in different levels of social anxiety. Understanding the diverse influences of these factors in the presence of different levels of social anxiety may lead to different strategies to improve IA in adolescents. Therefore, the purposes of this study was to (1) investigate the prevalence of IA in adolescents; (2) explore associated factors with IA in adolescents; and (3) understand how social anxiety affects the relationships between IA and its major sociodemographic factors.

Methods

Participants

The occupational schools in China usually include vocational high schools and higher vocational colleges. In this cross-sectional study, participants were recruited from five occupational schools in different cities or districts (Fuyang, Chuzhou, Tongling, Chaohu, Anqing) of Anhui province by using random cluster sampling. In each school, all students from first grade were invited to engage in the survey. A total of 10,574 adolescents were recruited, and 10,158 (96.07%) were finally included in the study.

As a unique population group in China, the vocational high school and higher vocational college students have their own characteristics in learning environment, daily life stress, and employment compared with ordinary high school and university students. They are often easy to turn to the Internet to seek out support and vent frustrations, making them a possible high-risk population of IA (Gao et al. 2011a; Niu and Liu 2012).

All participants who volunteered to participate in this study signed an informed consent form before participating in the study. All personal information of the participants was assured to be kept confidential. This study was approved by the Ethics Committee of Anhui Medical University, Hefei, China.

Measurements

Sociodemographic Variables

Sociodemographic information was collected. The present sample was divided into two groups according to age: < 18 or \geq 18 years old. Residence was classified as rural or urban areas, and the only child was classified as yes or no. Living conditions were classified as both parents or others. Parental education level was classified as primary school or below or above primary school, and parent-adolescent relationship was classified as bad or good. Parental control was divided into three grades: (1) little, (2) general, or (3) much. Annual family income was also divided into three grades: (1) < 10,000 yuan; (2) 10,000 ~ 30,000 yuan; and (3) > 30,000 yuan. Participants were required to assess their perceived academic performance compared with other peer students: poor, medium, or good. Physical exercise (days/week) was divided into three grades: (1) 0 days, (2) 1 ~ 3 days, and (3) > 3 days.

Internet Addiction

The Internet Addiction Test (IAT) was used to evaluate the severity of Internet addiction (Lai et al. 2013). The IAT consists of 20 items ranked on a 5-point Likert scale (1–5). Each IAT total

score (ranging from 20 to 100) was the sum of the scores for 20 items. A cutoff score of < 50 was defined as normal Internet use, and ≥ 50 as Internet addiction (Khazaal et al. 2008). The IAT is widely used, it has good validity and internal reliability (Sinkkonen et al. 2014; Stavropoulos et al. 2013). In our study, the internal validity of the scale was good (Cronbach's $\alpha = 0.886$).

Social Anxiety Symptoms

Social anxiety was measured by the Liebowitz Social Anxiety Scale (LSAS) (Liebowitz 1987). The LSAS, including fear and avoidance two subscales, is composed of 24 items. All items are rated on a 4-point scale, ranging from 0 = "none/never" to 3 = "severe/usually" (a total score ranging from 0 to 144). A cutoff score of ≥ 38 was defined as social anxiety (He and Zhang 2004). In our study, the internal validity of the scale was good (Cronbach's $\alpha = 0.953$).

Self-esteem

Self-esteem was evaluated by Rosenberg Self-esteem Scale (RSES) (Rosenberg 1965). The Chinese version of this scale translated by Wu et al. (2013) was used. The internal consistency was 0.757. The RSES consists of 10 items ranked on a 4-point Likert scale (1–4). Five of the items are positively stated and five are negatively stated. Each RSES total score (ranging from 10 to 40) was the sum of the scores for 10 items, with a higher score indicating higher self-esteem. In our study, the Cronbach α was 0.769.

Data Analysis

All statistical analyses were conducted using SPSS 16.0 and AMOS 21.0. Descriptive analyses were carried out for sociodemographic variables of participants. The χ^2 or t test was performed to compare prevalence of IA across different variables. Subsequently, multivariate logistic regression was conducted to assess the association between IA and the potential related factors. Correlation among variables was determined by Pearson's or Spearman's product-moment correlation coefficients. A path analysis was used to assess the direct or indirect association between related factors and IA. All two-sided P values that were less than 0.05 were considered statistically significant.

Results

Social Demographic Characteristics

The sociodemographic characteristics of study sample are illustrated in Table 1. Among these 10,158 participants, there were 4716 males (46.4%) and 5442 females (53.6%), and the age distribution of this population were < 18 (18.1%) and ≥ 18 (81.9%). 76.1% of the enrolled participants lived in rural areas. Approximately 24.5% of participants were only child, and 85.0% of participants lived with their parents. In addition, among them, 47.7% of their mothers received primary school or below, and 7.4% of their mothers had a bad relationship with them. 22.8% of their fathers received primary education or below, and 11.0% of their fathers had a bad relationship with them. Among 50.9% of participants, their parental controls were general.

Among 47.9% of them, their annual family incomes were 10,000 ~ 30,000 yuan. Approximately 67.7% of them thought their academic performances were medium, and 64.2% of them said their physical exercise was 1 ~ 3 days/week. Moreover, 10.4% of participants were Internet addicts.

The Associated Factors of Internet Addiction Among Adolescents

Table 1 shows that there were statistically different data in gender, age, the only child, mother-adolescent relationship, father-adolescent relationship, parental control, annual family income, academic performance, physical exercise, RSES score, and LSAS score between IA group and normal Internet use group ($P < 0.05$). However, residence, living conditions, and parental education level were not significantly associated with IA among adolescents ($P > 0.05$).

The results of the multivariate logistic regression analysis showed that females were less likely to report IA than males (OR = 0.712, $P < 0.001$). The only child, high annual family income, and social anxiety were risk factors for IA among adolescents ($P < 0.05$); good father-adolescent relationship, general parental control, good academic performance, physical exercise, and high level of self-esteem were protective factors for IA among adolescents ($P < 0.05$). However, age and mother-adolescent relationship did not enter the final regression model, which may have no effect on IA among adolescents (Table 2).

The Relationships Between the Factors and Internet Addiction Stratified by the Level of Social Anxiety

The relationships between the Factors and IA stratified by the level of social anxiety were further explored; these relationships are summarized in Table 3. Gender, the only child, father-adolescent relationship, high annual family income (> 30,000 yuan), academic performance, physical exercise, the level of self-esteem, and social anxiety were significantly associated with IA among adolescents in the SA group ($P < 0.05$). In addition, gender, general parental control, annual family income, medium academic performance, physical exercise, the level of self-esteem, and social anxiety were significantly associated with IA among adolescents in the NSA group ($P < 0.05$).

Factors Associated with Internet Addiction: a Path Analysis

The results of correlation test showed that father-adolescent relationship was positively correlated with parental control, physical exercise, and self-esteem, but negatively correlated with social anxiety and IA ($P < 0.05$). Parental control was positively correlated with family income and physical exercise. In addition, family income was positively correlated with self-esteem and IA, but negatively correlated with social anxiety. Physical exercise was positively correlated with self-esteem, but negatively correlated with social anxiety and IA. Self-esteem was negatively correlated with social anxiety and IA. Social anxiety was positively correlated with IA (Table 4).

A path analysis was conducted for comprehensively understanding the associations between influential factors and IA among adolescents. After referring to previous studies and our relevant results, following model demonstrated good fit ($\chi^2 = 105.018$, $P < 0.001$, CFI = 0.976, TLI = 0.904, RMSEA = 0.037). It included six factors (Figure 1): father-adolescent relationship, parental control, physical exercise, family income, self-esteem, and social anxiety. The

Table 1 Comparison of Internet addiction among adolescents with different demographic characteristics

Variables	All of sample	Internet addiction	Normal Internet use	χ^2_t	<i>P</i>
Total sample	10,158	1059 (10.4)	9099 (89.6)		
Gender				5.00	0.025
Boys	4716	526 (11.2)	4190 (88.8)		
Girls	5442	533 (9.8)	4909 (90.2)		
Age (years)				27.21	<0.001
< 18	1834	253 (13.8)	1581 (86.2)		
≥ 18	8324	806 (9.7)	7518 (90.3)		
Residence				3.56	0.059
Rural	7729	781 (10.1)	6948 (89.9)		
Urban	2429	278 (11.4)	2151 (88.6)		
The only child				4.07	0.044
Yes	2487	286 (11.5)	2201 (88.5)		
No	7671	773 (10.1)	6898 (89.9)		
Living conditions				1.17	0.279
Both parents	8632	888 (10.3)	7744 (89.7)		
Others	1526	171 (11.2)	1355 (88.8)		
Mother's educational level ^a				2.14	0.144
Primary school or below	4844	482 (10.0)	4362 (90.0)		
Above primary school	5221	566 (10.8)	4655 (89.2)		
Father's educational level ^a				0.31	0.579
Primary school or below	2315	236 (10.2)	2079 (89.8)		
Above primary school	7766	823 (10.6)	6943 (89.4)		
Mother-adolescent relationship ^a				45.18	<0.001
Bad	756	133 (17.6)	623 (82.4)		
Good	9309	915 (9.8)	8394 (90.2)		
Father-adolescent relationship ^a				56.08	<0.001
Bad	1118	188 (16.8)	930 (83.2)		
Good	8963	858 (9.6)	8105 (90.4)		
Parental control				31.05	<0.001
Little	835	115 (13.8)	720 (86.2)		
General	5173	458 (8.9)	4715 (91.1)		
Much	4150	486 (11.7)	3664 (88.3)		
Annual family income (yuan)				16.34	<0.001
< 10,000	3677	337 (9.2)	3340 (90.8)		
10,000 ~ 30,000	4867	515 (10.6)	4352 (89.4)		
> 30,000	1614	207 (12.8)	1407 (87.2)		
Academic performance				115.52	<0.001
Poor	1899	327 (17.2)	1572 (82.8)		
Medium	6876	612 (8.9)	6264 (91.1)		
Good	1383	120 (8.7)	1263 (91.3)		
Physical exercise (days/week)				92.00	<0.001
0	2042	327 (16.0)	1715 (84.0)		
1 ~ 3	6520	616 (9.4)	5904 (90.6)		
> 3	1596	116 (7.3)	1480 (92.7)		
RSES ^b score	28.0 ± 3.7	25.9 ± 3.8	28.2 ± 3.6	19.17	<0.001
LSAS ^c score	35.8 ± 22.1	48.2 ± 25.2	34.4 ± 21.3	- 17.10	<0.001

Data were presented as *n* (%) or mean ± standard deviation

^a Mother or father of some adolescents died

^b RSES Rosenberg Self-esteem Scale

^c LSAS: Liebowitz Social Anxiety Scale

model suggested that self-esteem, parental control, and family income had both direct and indirect effects on IA. Father-adolescent relationship and physical exercise only had indirect

Table 2 Multivariate logistic regression analysis including variables associated with Internet addiction

Variables	β^a	S.E. ^b	OR ^c (95% CI)	χ^2	P
Gender girls/boys	-0.34	0.07	0.712 (0.620, 0.818)	23.10	<0.001
Age (years) ≥ 18 / < 18	-0.07	0.08	0.937 (0.794, 1.105)	0.61	0.436
The only child no/yes	-0.16	0.08	0.849 (0.726, 0.994)	4.16	0.041
Mother-adolescent relationship					
Good/bad	-0.13	0.14	0.878 (0.674, 1.145)	0.92	0.338
Father-adolescent relationship					
Good/bad	-0.29	0.12	0.751 (0.598, 0.945)	6.00	0.014
Parental control					
General/little	-0.27	0.12	0.766 (0.602, 0.974)	4.74	0.029
Much/little	0.03	0.12	1.034 (0.812, 1.318)	0.08	0.784
Annual family income (yuan)					
10,000 ~ 30,000/ $< 10,000$	0.22	0.08	1.249 (1.070, 1.457)	7.98	0.005
$> 30,000$ / $< 10,000$	0.52	0.10	1.683 (1.381, 2.050)	26.70	<0.001
Academic performance					
Medium/poor	-0.43	0.08	0.654 (0.558, 0.766)	27.64	<0.001
Good/poor	-0.27	0.12	0.766 (0.603, 0.973)	4.76	0.029
Physical exercise (days/week)					
1 ~ 3/0	-0.41	0.08	0.667 (0.572, 0.779)	26.30	<0.001
$> 3/0$	-0.62	0.12	0.536 (0.423, 0.679)	26.62	<0.001
RSES ^d score	-0.11	0.01	0.894 (0.876, 0.912)	114.89	<0.001
LSAS ^e score	0.02	0.00	1.019 (1.016, 1.022)	144.99	<0.001

^a β linear regression coefficient

^b S.E. standard error

^c OR odds ratios

^d RSES Rosenberg Self-esteem Scale

^e LSAS Liebowitz Social Anxiety Scale

effects on IA mediated by self-esteem and social anxiety. Social anxiety imposed direct effect on IA among adolescents.

Discussion

This study used the IAT to evaluate the severity of IA among Chinese adolescents. A total of 10.4% could be described to experience “Internet addiction” in present study. The prevalence of IA was similar to other studies which diagnosed 10.4% high school students as Internet addicts from Guangzhou City (Lam et al. 2009) and which identified 10.6% of Chinese college students to be addicted to the Internet (Wu and Zhu 2004). In a 12,466 population-based cross-sectional survey, 1515 adolescents assessed by Young’s IAT found a prevalence of 12.2% (Wang et al. 2011), also similar to our results. However, a review focusing on larger populations showed that the prevalence of Internet addiction ranged from 0.8% in Italy to 26.7% in Hong Kong (Kuss et al. 2014). In addition, the prevalence of IA in adolescents was reported to be 3.2% in Germany, 15.5% in Hungary, and 18.7% in Taiwan (Pontes et al. 2015). The prevalence rates of Internet addiction reported by the above studies were different. The case of three possible explanation: (1) Because of regional differences in political, economic, cultural, and other aspects, which would affect people’s accessibility of the Internet; (2) Currently, official diagnostic criteria about IA do not exist, so definitions of Internet addiction in different studies may be different; (3) The variety of assessment instruments about IA exists.

Table 3 Multivariate logistic regression analysis including variables associated with Internet addiction according to different levels of social anxiety

Variables	SA ^a (4334)				NSA ^b (5824)			
	β^c	S.E. ^d	OR ^e	P	β^c	S.E. ^d	OR ^e	P
Gender girls/boys	-0.23	0.09	0.791	0.009	-0.51	0.12	0.602	<0.001
Age (years) ≥ 18 / < 18	0.06	0.11	1.058	0.600	-0.27	0.14	0.768	0.050
The only child no/yes	-0.31	0.11	0.737	0.004	0.01	0.12	1.009	0.942
Mother-adolescent relationship								
Good/bad	-0.27	0.16	0.767	0.105	0.16	0.25	1.177	0.507
Father-adolescent relationship								
Good/bad	-0.32	0.14	0.726	0.026	-0.23	0.20	0.798	0.256
Parental control general/little	-0.13	0.16	0.877	0.399	-0.48	0.20	0.617	0.015
Much/little	0.12	0.16	1.124	0.454	-0.11	0.20	0.894	0.572
Annual family income (yuan)								
10,000 ~ 30,000/ $< 10,000$	0.14	0.10	1.147	0.159	0.37	0.14	1.445	0.006
$> 30,000$ / $< 10,000$	0.39	0.13	1.483	0.003	0.72	0.16	2.051	<0.001
Academic performance								
Medium/poor	-0.48	0.10	0.619	<0.001	-0.32	0.14	0.728	0.019
Good/poor	-0.37	0.16	0.694	0.025	-0.11	0.19	0.901	0.578
Physical exercise (day/week)								
1 ~ 3/0	-0.36	0.10	0.699	<0.001	-0.48	0.13	0.619	<0.001
> 3 /0	-0.56	0.16	0.574	<0.001	-0.72	0.19	0.486	<0.001
RSES ^f score	-0.08	0.01	0.923	<0.001	-0.17	0.02	0.845	<0.001
LSAS ^g score	0.02	0.00	1.019	<0.001	0.01	0.01	1.012	0.033

^a SA social anxiety

^b NSA non-social anxiety

^c β linear regression coefficient

^e OR odds ratios

^d S.E. standard error

^f RSES Rosenberg Self-esteem Scale

^g LSAS Liebowitz Social Anxiety Scale

Gender was associated with IA among adolescents. Current study showed that males were associated with an increased risk of IA in both SA group and NSA group. This result was in agreement with the result from Lam et al. (2009) and Tsitsika et al. (2011) who suggested that

Table 4 The correlation coefficient between variables

	Father-adolescent relationship	Parental control	Family income	Physical exercise	Self-esteem	Social anxiety	Internet addiction
Father-adolescent relationship	1	0.097**	0.015	0.040**	0.146**	-0.080**	-0.082**
Parental control		1	0.046**	0.020*	0.019	0.004	0.019
Family income			1	0.009	0.034**	-0.049**	0.075**
Physical exercise				1	0.139**	-0.101**	-0.111**
Self-esteem					1	-0.387*** ^a	-0.301*** ^a
Social anxiety						1	0.335*** ^a
Internet addiction							1

* $P < 0.05$; ** $P < 0.01$

^a Pearson’s correlation test was performed, others were Spearman’s correlation test

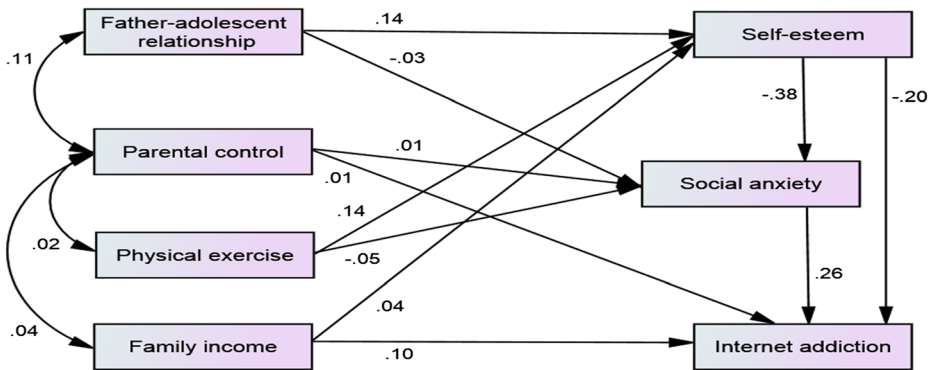


Fig. 1 The path standardized coefficient in the model

males were a potential risk factor of IA. However, other studies investigated that there was no difference between males and females on the level of IA (Ko et al. 2012; Wang et al. 2011). The reason might be the different online activities of males and females (Kim et al. 2006). Males are involved more frequently in high-risk Internet behaviors, including accessing the Internet for gambling practices and pornographic materials (Tsitsika et al. 2009).

Age was not associated with IA among adolescents. It was in consistent with previous study (Seyrek et al. 2017). However, Khazaal et al. (2008) indicated that younger Internet users were at higher risk of IA. This may be that the present participants were chosen from five districts representing sociocultural levels, and the age range was lower than in those of other studies. In addition, the adolescent who was the only child was more likely to be addicted to the Internet than who was not in SA group. This is perhaps because the only child is easy to be spoiled by parents at home. However, we did not find the same result in NSA group.

Parental educational background was not related to IA among adolescents. This result was consistent with Lam's (Lam et al. 2009) and Tsitsika's (Tsitsika et al. 2011) study. However, the present study found that bad father-adolescent relation was positively associated with IA among the total sample. The same association also existed in SA groups. The findings were in line with previous studies, which suggested that high parent-adolescent conflict predicted high prevalence rates of IA among adolescents (Wang et al. 2011; Yen et al. 2007b). If adolescents had a bad relationship with their parents, they would refuse to obey the supervision and discipline of their parents, including the rules set for Internet use. Eventually, adolescents would be more vulnerable to IA.

The present study demonstrated that appropriate parental supervision and control (not too much or too less, just adequate) negatively predicted IA among the total sample. The same association also existed in NSA groups. In ineffective family supervision, guidance, and discipline, adolescents usually have difficulty in controlling their online time (Floros et al. 2013). Thus, if parents provided effective supervision to adolescents, it can decrease the prevalence of IA among adolescents. However, if parental control was too severe, it would be counterproductive for their children because they feel a lot of pressure. In consistent with previous study (Gao et al. 2011b), this study suggested that high family economy was positively associated with IA. Our results indicated that low family income was a protective factor for IA among adolescents. Adolescents whose family had low household income cannot afford to buy computers, and adolescents also do not have enough pocket money to go to Internet cafes. Therefore, the less availability and opportunity lead to low prevalence of IA among adolescents.

Our study indicated that poor academic achievement was positively associated with IA among adolescents. The result was confirmed by previous studies which found adolescents with IA were significantly more likely to have poor academic performance (Mythily et al. 2008; Tsitsika et al. 2011). In addition, physical exercise was negatively associated with IA among adolescents. Similar result was found in other study (Khan et al. 2017). Adolescents who participate in any kind of physical activity tend to stay away from internet. They are inclined to healthy activities instead of spending time on internet. In addition, they often go to bed early because of physical tiredness.

Lower self-esteem was associated with more severe IA among adolescents. This was supported by previous study (Pantic et al. 2017). One possible reason may be that the Internet can offer users a chance to express themselves at certain degrees and help them feel confident in the virtual world (Ko et al. 2005). In line with previous studies (Ho et al. 2014; Ko et al. 2012), the results of multivariate logistic regression analysis showed that a positive correlation between IA and social anxiety was identified in current study. Adolescents who experienced social anxiety could use the Internet to relieve their depressive or social anxiety symptoms. The Internet could help them develop a “virtual world” (Mancini et al. 2005), which adolescents can hide and escape from social difficulty in the real world. However, if adolescents with social anxiety are not well treated, they will spend more and more time on the Internet (Yen et al. 2007a) and reduce the communication with others in the real world (Ko et al. 2012). The vicious cycle may lead to Internet addiction and the social anxiety become more severe.

In our path analysis, father-adolescent relationship and physical exercise imposed indirect effects on IA, which was mediated by self-esteem and social anxiety. While parental control was only mediated by social anxiety and family income was only mediated by self-esteem. Overall, social anxiety was the most important risk factor of IA among adolescents, which was followed by low self-esteem. As social anxiety played crucial roles, corresponding early prevention, intervention, and treatment are vital in preventing IA among adolescents.

Several limitations should take into consideration. Firstly, our study is the cross-sectional research design. Therefore, causal impact of social anxiety and other related factors on IA were not warranted without longitudinal verification. Secondly, the overall data came from the self-report questionnaires, but information was lacking from the teachers, caregivers, and parents. Thirdly, assessment instruments of Internet addiction were various, and IA lacked definite diagnostic criteria. Thus, the IAT may not be the best assessment instrument to evaluate the severity of IA. Further research would be conducted with more precise measurement on variables in this study.

Conclusion

In conclusion, we found 10.4% of adolescents experiencing Internet addiction. Results from this study suggested that multiple factors can affect Internet addiction among Chinese adolescents. The mediating effect of social anxiety between multiple factors and Internet addiction was also significant. These findings can provide guidance aimed at reducing Internet addiction among Chinese adolescents.

Acknowledgements We would like to particularly thank the students who gave of their time to participate in the project.

Funding This study was funded by National Natural Science Foundation of China (no.81202224) and the Anhui Provincial Natural Science Foundation (no.1208085QH148).

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Ethical Approval All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

Informed Consent Informed consent was obtained from all participants for being included in the study.

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