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Original Article

Prevalence and correlates of lifestyle behavior, anxiety and depression in Chinese college freshman: A cross-sectional survey

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ABSTRACT

Objectives: First-year college students had exposure to unhealthy lifestyle behaviors that correlate with a high prevalence of anxiety and depression. Regarding to the modifiable lifestyle behaviors factors, this study investigated the prevalence and correlation of multiple lifestyle behaviors, anxiety and depression in a sample of Chinese first-year college students.

Methods: Cross-sectional data were extracted from *Residents eHealth* app of health lifestyle behaviors survey from September to October 2019. Anxiety, depression, eating regular meals, consumption of snacks in-between meals, consumption of fruit, dessert and sugar-sweetened beverages, smoking and secondhand smoke exposure, consuming alcohol, physical activity, sedentary time were assessed by self-report. Socio-demographic including age, gender, education, family income, religion, and health condition were captured. Logistic regression was used to explore the association of multiple lifestyle behaviors, anxiety and depression.

Results: Totally 1,017 participants were included in the study. The prevalence of anxiety and depression (from mild to severe) were 40.3% and 45.3%, respectively. In multivariable analyses, religion (believe in Buddhism, $OR = 2.438$, 95%CI: 1.097–5.421; believe in Christian, $OR = 5.886$, 95%CI: 1.604–21.597), gender (Female, $OR = 1.405$, 95%CI: 1.001–1.971), secondhand smoke exposure ($OR = 1.089$, 95%CI: 1.001–1.184), and eating regular meals ($OR = 0.513$, 95%CI: 0.346–0.759) were associated with anxiety. Family income ($OR = 0.732$, 95%CI: 0.596–0.898), eating regular meals ($OR = 0.641$, 95%CI: 0.415–0.990), frequency of breakfast ($OR = 0.813$, 95%CI: 0.690–0.959), with a chronic disease ($OR = 1.902$, 95%CI: 1.335–2.712), and consumption of nocturnal snack ($OR = 1.337$, 95%CI: 1.108–1.612) were associated with depression.

Conclusions: These results highlighted the need for early lifestyle behavior intervention, especially modifying diet patterns considering the background of religion, health condition, and social-economic status in first-year college students to improve their mental health.

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What is known?

- Anxiety and depression are prevalent issues in college students all around the world.

- College students' lifestyle behaviors fall short of meeting recommended guidelines.

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What is new?

- The high prevalence of anxiety and depression in Chinese college freshmen needs timely intervention before progressing to a severe level.
- Skipping breakfast is a common phenomenon among Chinese college freshmen. Eating regular meals was negatively associated with anxiety and depression.
- Religion was positively associated with anxiety in Chinese college freshmen, which should be taken into consideration when designing lifestyle behaviors intervention to improve their mental health.

1. Introduction

Anxiety and depression are prevalent issues in college students all around the world. According to the new findings of WHO World Mental Health Surveys International College Student Project, one in three college freshmen has the common lifetime mental health disorders [1]. A recent survey in China shows that 6.6% of college students aged 19–22 years are highly risky of depression, and 5.4% have severe anxiety symptoms [2]. The presence of anxiety and depression can negatively impact academic performance [3–5] and lead to physical health problems [6], substance abuse, as well as suicidal behavior [7,8]. Regarding that, the college years are the peak time for the onset of anxiety and depression [1], and these disorders continue into adulthood; it is vital to focus on the mental health of college students.

College year represents a critical period of development transition from adolescence to the young adult life stages. With increasing pressure during transition periods, such as entering graduate from high school, mental disorders might occur [9]. Research supports that the transition from high school to college for students is stressful [10], and students often gain weight in the first year of their college experience [11,12]. In this specific period, emerging adults get autonomy to make living choices, eating and activities that they like. Many lifestyle-related attitudes and habits are formed at this stage and persist across the life span [13–15]. In China, especially in the prevalent one-child family, those who were considerably taken care of and well protected may experience a significant challenge to adapt to independent college living without limitations and discipline from parents. Researches have shown that college students' lifestyle behaviors fall short of meeting recommended guidelines [16,17]. Specifically, college students participate in low physical activity [18] and high level of sedentary time [19], initiate substance use [20,21], and do not meet vegetable and fruit recommendations [22]. These unhealthy lifestyle behaviors may increase the vulnerability to anxiety and depression.

Increasing amounts of evidence have shown that college student lifestyle behaviors such as eating habits, physical activity, sedentary time, smoking, and consuming alcohol associate with mental health, including anxiety and depression [22–25]. However, most previous studies examining these associations focused on one or two lifestyle behaviors. Given the multiple lifestyle behaviors simultaneously impact mental health, there is a need to examine the correlates of a greater number of lifestyle behaviors, anxiety and depression. Further, there are paucity studies focused on first-year college students. Regarding the key transition period for first-year college students and modifiable lifestyle behaviors, timely and effective intervention can be put into place as early as possible. Our study targeted college freshmen as participants.

Therefore, this study aims to investigate the prevalence of anxiety and depression in Chinese first-year college students and examine the correlates of multiple lifestyle behaviors (including

diet pattern, smoking and secondhand smoke exposure, consuming alcohol, physical activity, and sedentary time), anxiety and depression.

2. Method

2.1. Design and participants

Participants in this cross-sectional survey were recruited from a smartphone-based health management app named *Residents eHealth* in a multi-center study involving Beijing, Zhejiang, Jiangsu, Tianjin, Hebei, Anhui, Fujian, Gansu, Guizhou, Henan and Xinjiang et al., a total of 23 provinces and 3 municipalities in China. The project was launched in 2019 and recruited participants who use *Residents eHealth* to record their health data and receive self-management education information. From April to October in 2019, a total of 5,442 users entered *Residents eHealth* to complete the questionnaires in full or partially. In our study, a stratified sample of college freshmen who enrolled in the university located in eastern regions (Beijing, Zhejiang, Jiangsu), central regions (Henan and Anhui) and western regions (Gansu, Xinjiang and Guizhou) were selected. Eligibility criteria were attending grade one for the first time in a college/university and completed the questionnaire in the *Residents eHealth* app from September to October 2019. Those data were marked with repeated user IDs, and missing information that more than 5% of all were excluded. The survey consists of 173 items. The present study only reports those measures and results relevant to lifestyle behaviors, anxiety and depression. Approval for the study was obtained from Human Research Ethics Committee at Peking University (IRB00001052-19018). Informed consent was obtained from all participants before participating in the study. Of the 1,275 respondents, 1,017 participants completed the questionnaires in full.

2.2. Data collection instruments and measures

2.2.1. Socio-demographics

The socio-demographic data include age, gender (1 = male, 2 = female), education (1 = associate's degree, 2 = bachelor's degree), family monthly income per capita (1 = <2,000, 2 = 2,000–5,000, 3 = > 5,000), and religion (dummy variables for religion using no religion as reference group). The health condition was assessed by asking about presence of chronic diseases (0 = No, 1 = Yes).

2.2.2. Lifestyle behavior measures

Lifestyle behaviors in the questionnaire include diet pattern, smoking and secondhand smoke exposure, consuming alcohol, physical activity and sedentary time.

Diet pattern was addressed by questions with 10 items regarding eating regular meals (0 = No, 1 = Yes), weekly frequency of eating breakfast, lunch and dinner, weekly frequency of having snacks in-between meals, weekly frequency of consuming desserts, fruits and sugar-sweetened beverages (1 = never, 2 = 1–2 days a week, 3 = 3–4 days a week, 4 = 5–6 days a week, 5 = every day).

Smoking status was assessed using 6 items about the frequency of smoking in the past 30 days (1 = non-smoker, 2 = ever smoked, 3 = smoking sometimes, 4 = smoking every day). More questions like the history of smoking or quitting smoking, the number of cigarettes per day or before quit smoking, the age of begin smoking will be asked if the respondent choose 2, 3 or 4, household members smoked inside the home or roommates smoked in dorms (0 = No, 1 = Yes), the day's exposure to secondhand smoke over 15 min per week in average (1 = none, 2 = 1–2 days, 3 = 3–5 days, 4 = almost every day, 5 = have no idea).

Alcohol consumption was assessed by 4 items: the frequency (1 = never drink, 2 = less than once a month, 3 = 2–4 times a month, 4 = more than once a week), the history of consuming or quitting consuming alcohol, the type of alcohol, the amount of consumption per day.

Physical activity and sedentary time in the past seven days were assessed by 7-items Chinese version of the International Physical Activity Questionnaire short form (IPAQ-C). IPAQ-C was verified as a valid instrument to measure health-related physical activity [26]. The IPAQ-C asks participants the days who spent doing the violent-intensity activity, moderate-intensity activity, walking and sitting in the last 7 days, respectively, and the duration of each activity at a time (at least 10 min). According to the computing protocol, metabolic equivalent (MET) scores were summed by multiplying the total minutes spent on each domain of activities and 8.0, 4.0 and 3.3, respectively, indicating the activity levels (1 = low intensity, 2 = moderate intensity, 3 = high intensity).

2.2.3. Anxiety and depression

Anxiety was assessed using 7-items Generalized Anxiety Disorder (GAD-7) [27], a measure assessing the severity of anxiety disorder in the past two weeks. Each item was scored from 0 to 3 (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). Scores of 5, 10 and 15 represent cutpoints for mild, moderate, and severe anxiety, respectively.

Depression was assessed using the Patient Health Questionnaire-9 (PHQ-9) [28], a measure assessing the severity of depression. The PHQ-9 asks how often participants have been bothered by depression symptoms in the past two weeks. The 9-Items are rated on a 4-point Likert scale, ranging from 0 (not at all) to 3 (nearly every day). The total score was obtained by adding the score for each question ranging from 0 to 27, with higher scores indicating the more severe symptom of depression. The total score can then be interpreted as indicating none-minimal depression (score 0–4), mild depression (score 5–9), moderate depression (score 10–14), or moderately severe depression (score 15–19), and severe depression (score 20–27).

2.3. Statistics analysis

Descriptive characteristics were summarized and presented as count, percentages, mean and standard deviation. Mann-Whitney *U* test and Chi-square tests were used to examine the differences between socio-demographics and each lifestyle behavior with the presence or absence of anxiety and depression. Logistic regression analysis was used to examine the relationship between lifestyle behavior and anxiety, as well as depression. The results were presented adjusted OR with 95% CI. Statistical analysis was conducted in SPSS (version 14) and α was set at 0.05.

3. Result

Characteristics of participants are summarized in Table 1. The prevalence of anxiety was 40.3% (410/1,017), and the proportion of severity of anxiety from mild to severe was 36.1% (367/1,017), 2.6% (26/1,017) and 1.7% (17/1,017), respectively. Similarly, the prevalence of depression was 45.3% (461/1,017), and the proportion of severity of depression from mild to severe was 35.4% (360/1,017), 7.7% (78/1,017), 1.4% (14/1,017) and 0.9% (9/1,017), respectively. A large proportion of participants eat meals regularly (86.0%, 875/1,017). Specifically, the proportion of eating breakfast, lunch and dinner every day was 46.6% (474/1,017), 87.1% (886/1,017) and 67.6% (687/1,017), respectively. The proportion of skipping breakfast more than once a week was 53.4% (543/1,017). More than half of participants consumed desserts, fruits and sugar-sweetened

beverages more than three days per week. A large proportion of participants consumed nocturnal snack more than once a week (77.0%, 783/1,017). Most participants were non-drinker (82.9%, 843/1,017), non-smoker (97.1%, 987/1,017), and a small proportion of secondhand smoke exposure (31.4%, 319/1,017). The proportion of physical activity in low, moderate and high intensity was 37.0% (376/1,017), 53.3% (542/1,017) and 9.7% (99/1,017), respectively. Most participants reported the sedentary time less than 8 h (80.7%, 821/1,017).

Gender, religion, chronic disease, secondhand smoke exposure, eating regular meals (including frequency of lunch and dinner), consumption of snack in-between meals, consumption of desserts, and sugar-sweetened beverages were significantly associated with anxiety univariate analyses. Family income, chronic disease, consuming alcohol, eating regular meals (including breakfast, lunch and dinner), consumption of snack in-between meals, consumption of desserts, and sugar-sweetened beverages were significantly associated with depression in univariate analyses. Table 2 and Table 3 shows the estimated coefficients from logistic regression analyses after adjusting for socio-demographics and health condition. Religion (believe in Buddhism : OR = 2.438, 95% CI: 1.097–5.421; believe in Christian: OR = 5.886, 95% CI: 1.604–21.597), gender (OR = 1.405, 95% CI: 1.001–1.971), secondhand smoke exposure (OR = 1.089, 95% CI: 1.001–1.184), and eating regular meals (OR = 0.513, 95% CI: 0.346–0.759) were associated with anxiety. Family income (OR = 0.732, 95% CI: 0.596–0.898), eating regular meals (OR = 0.641, 95% CI: 0.415–0.990), frequency of breakfast (OR = 0.813, 95% CI: 0.690–0.959), with a chronic disease (OR = 1.902, 95% CI: 1.335–2.712), and consumption of nocturnal snack (OR = 1.337, 95% CI: 1.108–1.612) were associated with depression.

4. Discussion

This cross-sectional study aimed to investigate the prevalence of anxiety and depression in Chinese college freshmen and examine the correlations of multiple lifestyle behaviors, anxiety, and depression. In our study, 40.3% of participants suffering from varying degrees of anxiety, and 45.3% experiencing mild to severe depression. First-year female college students with religious affiliations and without regular dietary behavior and had a high possibility of exposure to secondhand smoke were more likely to get anxiety. At the same time, those with chronic disease, low family income, and without regular dietary behavior (skipping breakfast and consuming nighttime snacks) were had an increased risk of getting depression.

The prevalence of anxiety and depression was higher than the 35.3% of lifetime disorders among other eight countries first-year college students [1]. The different measure and time frames may cause the variation. It is noteworthy, though, that the high prevalence of anxiety and depression in first-year college students needs timely intervention before progressing to a severe level.

Inconsistent with many previous studies, religion was positively associated with anxiety, and non-significant with depression. In Braam et al.'s systematic review, 41% of studies ($n = 152$) didn't report a significant association between religiousness and depression, especially in samples of youth, adolescents and students [29]. Although geographical differences were not statistically significant, it is noteworthy that studies originating in East Asia, especially in China, were less. In our study, only a small number of college students (4.7%) had religious beliefs, which was in line with Wei et al.'s survey in China [30]. In fact, religion was a less profound impact on social and cultural life in China compared to countries in North America and the Middle East. College students with religious affiliations may search for social support from coreligionists.

Table 1
Anxiety and depression according to socio–demographic characteristics.

Characteristic	Total group (n = 1,017)	GAD-7				PHQ-9			
		Anxiety	No anxiety	χ^2	P	Depression	No depression	χ^2	P
Age	19 (18,19)	19 (18,19)	19 (18,19)	-1.178 ^a	0.239	19 (18,19)	19 (18,19)	0.238 ^a	0.812
Gender				4.064	0.044			3.007	0.083
Male	226 (22.2)	78 (34.5)	148 (65.5)			91 (40.3)	135 (59.7)		
Female	791 (77.8)	332 (42.0)	459 (58.0)			370 (46.8)	421 (53.2)		
Education				1.873	0.371			0.420	0.193
Associate's degree	183 (18.0)	82 (44.8)	101 (55.2)			79 (43.2)	104 (56.8)		
Bachelor's degree	834 (82.0)	328 (39.3)	506 (60.7)			382 (45.8)	452 (54.2)		
Religion				15.626	0.001			2.661	0.450
No religion	969 (95.3)	379 (39.2)	589 (60.8)			434 (44.8)	534 (55.2)		
Buddhism	29 (2.8)	18 (62.1)	11 (37.9)			15 (51.7)	14 (48.3)		
Christian	14 (1.4)	11 (78.6)	3 (21.4)			9 (64.3)	5 (35.7)		
Others	5 (0.5)	1 (20.0)	4 (80.0)			2 (40.0)	3 (60.0)		
Family monthly income per capita (CNY)				0.083	0.959			9.732	0.008
< 2000	149 (14.7)	61 (40.9)	88 (59.1)			77 (51.7)	72 (48.3)		
2,000–5,000	583 (57.3)	236 (40.5)	347 (59.5)			276 (47.3)	307 (52.7)		
> 5,000	285 (28.0)	113 (39.6)	172 (60.4)			108 (37.9)	177 (62.1)		
With a chronic disease				4.584	0.032			11.926	0.001
No	854 (84.0)	332 (38.9)	522 (61.1)			367 (43.0)	487 (57.0)		
Yes	163 (16.0)	78 (47.9)	85 (52.1)			94 (57.7)	69 (42.3)		

Note: Data are n (%), or Median (P₂₅, P₇₅),^a Z value, Mann-Whitney U test. GAD-7 = 7-items Generalized Anxiety Disorder. PHQ-9 = Patient Health Questionnaire-9.

Table 2
Logistic regression results of factors associated with anxiety (n = 1,017).

Variable	B	OR (95%CI)	P
Religion (No religion as reference)			0.006
Religion (Buddhism)	0.891	2.438 (1.097–5.421)	0.029
Religion (Christian)	1.773	5.886 (1.604–21.597)	0.008
Religion (others)	-1.016	0.362 (0.039–3.359)	0.372
Gender (Male as reference)	0.340	1.405 (1.001–1.971)	0.049
With a chronic disease	0.314	1.369 (0.965–1.942)	0.078
Secondhand smoke exposure	0.085	1.089 (1.001–1.184)	0.048
Regular meals	-0.668	0.513 (0.346–0.759)	0.001
Snack after breakfast	0.154	1.166 (0.987–1.379)	0.072
Lunch	-0.161	0.851 (0.658–1.101)	0.220
Snack after lunch	-0.013	0.987 (0.833–1.170)	0.879
Dinner	-0.040	0.961 (0.814–1.134)	0.640
Nocturnal snack	0.186	1.204 (0.999–1.451)	0.051
Desserts	-0.087	0.916 (0.781–1.075)	0.284
Sugar-sweetened beverages	-0.035	0.966 (0.835–1.117)	0.641
Physical activity	0.086	1.090 (0.886–1.340)	0.415
Constant	-1.100	–	0.445

However, limited coreligionists may attenuate the network of mutual aid that helps to reduce the negative emotion. Furthermore, negative religious coping was proved associated with an increase in symptoms of anxiety [31]. This study did not investigate the

Table 3
Logistic regression results of factors associated with depression (n = 1,017).

Variable	B	OR (95%CI)	P
With a chronic disease	0.643	1.902 (1.335–2.712)	0.000
Family income	-0.312	0.732 (0.596–0.898)	0.003
Alcohol consumption	0.222	1.249 (0.958–1.628)	0.100
Regular meals	-0.445	0.641 (0.415–0.990)	0.045
Breakfast	-0.206	0.813 (0.690–0.959)	0.014
Snack after breakfast	0.062	1.064 (0.900–1.258)	0.466
Lunch	-0.259	0.772 (0.587–1.015)	0.064
Snack after lunch	0.058	1.060 (0.896–1.254)	0.498
Dinner	-0.159	0.853 (0.723–1.007)	0.060
Nocturnal snack	0.290	1.337 (1.108–1.612)	0.002
Desserts	-0.088	0.916 (0.783–1.072)	0.274
Sugar-sweetened beverages	0.065	1.067 (0.923–1.234)	0.382
Physical activity	-0.445	0.641 (0.415–0.990)	0.756
Constant	2.645	–	0.002

dimension of religious coping that needs to examine the relationship in the future study.

The weakly significant correlation between gender and anxiety in our study was compatible with previous studies [9,32–34]. To be more specific, females reported having a higher level of anxiety. It suggested that gender differences should be taken into consideration when designing anxiety intervention programs for college students. Further studies need to expand the sample size to replicate the result.

The finding for the positive association between passive smoking and anxiety was consistent with many prior findings [35–38]. However, some researchers found that exposure to secondhand smoke was not related to anxiety in non-smoking adults [39]. The difference could be explained that retrospective self-reports of secondhand smoke exposure can lead to bias, and the relationship could be mediated by other psychosocial factors. Thus, further studies with a big sample through biological data collection to confirm the causation relationship between secondhand smoke exposure and anxiety are needed. Nevertheless, our study suggested focusing on preventing secondhand smoke exposure in campus settings.

The finding regarding diet was consistent with previous findings that meal frequency was negatively associated with anxiety and depressive symptoms [40–42]. In our study, a high proportion of skipping breakfast more than once a week (53.4%) was observed. Participants who skipped breakfast more than once a week had an increased risk of depressive symptoms compared to those who ate breakfast every day. Our finding adds to the growing evidence that the frequency of breakfast was negatively related to depressive disorders [43–46]. The mechanism explaining the association could be the effect of the high level of cortisol and dysregulation of the hepatic circadian clock [47–49]. However, in the present study, skipping lunch and dinner was not significantly associated with depression. In addition, eating nighttime snacks was found positively related to depression. A high proportion of participants consuming nighttime snacks more than once a week (77.0%) was observed, which may occur due to overtime work [1] and entertainment [50]. Our finding was supported by previous studies reporting that people with night eating syndrome who consume nighttime snacks had higher depression [51–53]. The mechanism underlying the association may be explained by the changed

hormone secretions, including melatonin and leptin. Night eaters have lower plasma melatonin and leptin levels and higher levels of plasma cortisol relative to non-night eaters [54], which may lead to impaired sleep. Studies have proved that sleep duration and sleep quality were negatively correlated with depression [46,55,56]. However, the relationship between frequency of eating in-between meal snacks and depression was not significant, which was consistent with Fulkerson et al.'s study [41]. Additionally, the null association between the intake of fruit, desserts, sugar-sweetened beverages, and mental disorders after adjusting the confounding factors was observed, inconsistent with previous studies [22,57]. Hence, further study is needed to determine the potential factors mediated between consuming fruit, sweets and soft drinks with mental disorders. These results indicating that keeping an everyday breakfast routine and avoiding night eating may benefit college freshmen.

The finding regarding family income was significantly negative with depression was in line with many other studies [58,59]. The economic disparity from different regions co-occurred with the rapid development of the economy in China. College students from lower social-economic status families may experience stress when compared with peers who come from higher social-economic status families. The less advantaged college students may have low self-esteem, which would lead to depressive symptoms [60]. Moreover, low family income may limit access to protective resources and relationships to relieve depression [61]. This result suggests that we should consider the socio-economic background of college freshmen when developing mental health programs.

Findings for the positive relationship between illness and depression were compatible with previous studies [62,63]. It has been well proved that depression frequently occurs due to comorbid medical conditions [64]. The presence of a disease, especially a chronic disease, may add the burden of absencing or suspending the study. College students with chronic disease may also feel loneliness and isolation [65], which has been an important mediator of health behavior associated with depression among college students [66,67].

In contrast to previous studies, physical activity and sedentary behavior were not significantly associated with mental health in the current study. The prevalence of low physical activity (37.0%) was similar to a previous study [18] in Chinese college students (37.3%), but the prevalence of moderate physical activity (53.3% vs. 36.9%) was higher and high physical activity (9.7% vs. 25.8%) was lower. At the same time, the mean sedentary time in our study (5.8 h) was lower than an other study (7.51 h) in China [68]. These differences may exist because of series of policies issued by the government. For example, a new policy stipulates that undergraduates couldn't get an academic degree if they fail to reach the physical fitness qualification standard [69]. These policies force college students to participate in physical activity, which may increase the proportion of moderate physical activity. However, we found no statistical significance between the different intensity of physical activity and mental health, neither the physical activity rank. On the contrary, participants with a higher physical activity level reported the highest proportion of anxiety and depression than low and moderate physical activity in univariate analysis. This result reminds us that physical activity is a healthy behavior and a coping mechanism to relieve negative psychological status [70]. Thome et al.'s study demonstrated that neither exercise behavior nor coping through exercise was negatively associated with depression, and only coping through exercise was associated with lower anxiety [71]. In the present study, college students' reasons for participating in physical activity have not been addressed. Further research is warranted better to understand the causation between physical activity and mental health.

Notably, consuming alcohol was correlate with depression in univariate analysis, although the difference was not significant in the regression equation after adjusting for the confounding factors. Findings on the association in existing evidence have been mixed and controversial [25,35,39,72,73]. In our study, participants who responded to the survey were mostly female, which may lead to information bias. It suggested that the association between consuming alcohol and mental health in college students deserves further study.

4.1. Implications for school health

At the background of the high prevalence of anxiety and depression among college students worldwide, the school health team should become cognizant of formulating intervention programs regarding multiple lifestyles from the first school year. The transition from adolescence to the young adult life stages is a critical time cultivating student lifestyle habits. It may be more effective in changing behaviors earlier than in later periods.

School health team should provide first-year students effective educational programs, including providing accurate information regarding appropriate meal times, the importance of eating breakfast, the disadvantages of consuming nocturnal snacks, appropriate sweet and soft drink amounts, etc. School health teams could partner with teachers in the college student mental health curriculum, adding the educational information into mental health content. Students may be more accepting to learn healthy behaviors from health professionals.

Along with the education, there could be activities that engender college students eating meals together in a group setting, whomever they would like to participate at the recommended times and share healthy food with their classmates. These activities could include introverted students who have not live good lifestyle habits.

Lastly, when evaluating students at risk of anxiety and depression, the school health team should be sensitive to students' backgrounds, especially in their religious beliefs, social-economic status, and health condition. Providers in school mental health services need to be prepared in cultural sensitivity to meet students' mental health needs and cultural support. There could be an institutional strategy to support students in clinical treatment and create a healthy lifestyle behavior plan for those of low social-economic status.

4.2. Limitations

The main limitation of the present study is that no cause and effect can be determined in the cross-sectional design study. It suggested that the structural equation model can be used to exam the direct and moderate variates between lifestyle behaviors and mental health in the future. Although the response rate was acceptable in the present study, there is a possibility that the students who were absent from some items and survey administration could be at higher risk for anxiety and depression. Additionally, the participant who responded to the survey were mostly female, making the result show better behavior in smoking and consuming alcohol.

5. Conclusions

In conclusion, this study demonstrated that the prevalence of anxiety and depression in Chinese college freshmen were 40.3% and 45.3%, respectively. Eating regular meals is significantly associated with less likely to be anxiety and depression, while skipping breakfast and consuming nighttime snacks increase the possibility

of suffering from depression. College freshmen had religious beliefs, female, and secondhand smoke exposure may increase the possibility of anxiety. More family income and healthier conditions may prevent getting depression. This supports the idea that early interventions may target improvements on regular lifestyle behaviors, especially modifying diet routine with the consideration of the background of religion, gender, health condition and social-economic status in college freshmen, as well as establishing a smoke-free campus environment to improve and maintain students' mental health.

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CRediT authorship contribution statement

Chenchen Gao: Data curation, Writing – original draft, Writing – review & editing. **Yumei Sun:** Investigation, Writing – original draft, Writing – review & editing. **Feifei Zhang:** Investigation, Data curation. **Fang Zhou:** Data curation, Writing – review & editing. **Chaoqun Dong:** Investigation, Data curation. **Ziwei Ke:** Investigation, Data curation. **Qingyan Wang:** Data curation. **Yeqin Yang:** Conceptualization, Supervision, Writing – review & editing. **Hongyu Sun:** Conceptualization, Supervision, Writing – review & editing.

Declaration of competing interest

We confirm that there is no financial/personal interest or belief that could affect our objectivity.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2021.05.013>.

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