

# RISK FACTORS FOR EATING DISORDERS AMONG CHINESE AND INTERNATIONAL UNIVERSITY STUDENTS: A COMPARATIVE CROSS-SECTIONAL STUDY

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## SUMMARY

**Objective:** The aim of the study was to investigate the prevalence of eating disorders (EDs) and their association with socio-demographic and behavioural factors among university students.

**Methods:** A cross-sectional study among university students (Chinese and international) in Nanjing, China. We collected the data from 877 students, of which 811 were eligible for this study. They submitted a self-administered questionnaire (Eating Disorder Examination Questionnaire 6 (EDE-Q6)) related to socio-demographic, health variables and lifestyle factors. Data were assessed with the help of SPSS software.

**Results:** A total of 401 Chinese and 410 international university students (49.44% vs. 50.55%) participated in this study. Binary logistic regression showed that young female adults of 18–25 years of age had more risk of developing eating disorders. Higher body mass index (BMI), such as overweight and obesity, were more influential risk factors ( $p < 0.001$ ) for eating disorders. The significant risks ( $p < 0.001$ ) EDs were found in students who were athletes, physically active, and involved in various extra-curricular activities. Alcohol and smoking were significant risk factors associated with eating disorders.

**Conclusion:** The results indicated higher risks of eating disorders followed by objective binge eating and compensatory behaviour. In this scenario, early assessment and treatment are necessary to reduce the burden of eating disorders and to promote good nutritional practices among university students.

**Key words:** EDE-Q, compensatory behaviour, risk factors, binge eating disorder, cross-sectional studies

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## INTRODUCTION

Eating disorders (EDs) are behavioural and pernicious mental illnesses characterized by exemplars of maladaptive cognitions, irregular eating, exercise, and weight (1). Eating disorders feign a prominent public health threat to the lives of all individuals, with notably high prevalence rates among women, especially girls, most often between the ages of 12–35 years (2). Previous research data suggests that age, especially the onset of puberty, robustly enhances risks for EDs. Different studies reveal that university students are at high-risk for EDs psychopathology (3–6). The aetiology and risk factors for EDs remain unclear, but according to various studies, gender, age, BMI, university education, smoking, alcohol, physical activities, and extra-curricular activities are discussed as reasons for its increased risk (7–10).

Many studies were performed on females by considering the high-risk population, but nowadays, there is no gender disparity in the modern world (11). Despite gender, other factors such as ethnic differences, migrants, athletic students, global urbanization, and media-influenced westernization are considered another high-risk group (12–15).

According to various studies, the prevalence of EDs among the young population is increasing from 4% to 38% in South Asia, including countries such as China, Pakistan, India, and Bangladesh (16, 17). Undeniably, EDs are considered a complex mental illness with the highest rate of medical complications of any psychiatric disorder, including hair loss, loss of tooth enamel, osteoporosis or growth retardation, electrolyte imbalances, dehydration, gastrointestinal bleeding, bowel paralysis, cardiac arrest, hypernatremia, and hypokalemia etc. In complicated situations, it

may lead to different physical, physiological, and psychological disorders such as anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED) (18). Moreover, the type and degree of medical complications are associated with ED behaviours, particularly self-induced vomiting, starvation, and binge eating. Individuals with severe AN are more prone to experience the largest number of these medical consequences. Thus, it is critical to recognize the risk factors that influence EDs because subclinical disordered eating is more prevalent than a full eating disorder. It puts an individual at risk for severe clinical EDs symptomatology. However, early intervention and prevention are required for a better understanding of nuanced risk factors. Effective population-level strategies are required to be implemented to address the high prevalence of EDs in universities.

Lack of early detection, prevention, and intervention of EDs and associated risk factors may remain a major threat to university students in China due to unsettled questions/methodologies. The prevalence and risk of EDs for international students from diverse cultures are poorly understood. Therefore, a study was needed to address the risk profile of multi-universities. This research included students from all universities in Nanjing to estimate the prevalence and risk factors for EDs. Overall, the primary purpose of this study was to determine the prevalence of EDs symptomatology and early identification of risk factors for EDs among university students and administration of early intervention and prevention strategies in universities as universities are considered an ideal setting.

## MATERIALS AND METHODS

### Participants

A comparative cross-sectional survey was organized to collect the data from university students in Nanjing, who were representatives of national demographics. Chinese and international students from universities in Nanjing were invited to participate in this study to fill the self-reported questionnaire using the most famous Chinese app WeChat. The survey was managed by wjx.cn survey software\*, and participation was voluntary, confidential, and anonymous. A total of 877 students participated in this study, out of which 447 were Chinese, and 430 were international. However, this investigation only included participants above 18 years of age who enrolled in Nanjing universities. Finally, 811 students (410 international and 401 Chinese) were included for further analysis. The response rate was 92.47% (Fig.1).

### Instrument

*Eating Disorder Examination Questionnaire 6 (EDE-Q6)* (19) for young adults (18+) is a 28-items self-reported questionnaire recalling the attitude and behaviour in the last 28 days. The data provided by EDE-Q6 is the frequency of behaviour and psychopathology of the behaviour by the subscales. The subscales are the global scale and four subscales (restraint, eating concern, weight concern, and shape concern). Items comprising the global scale

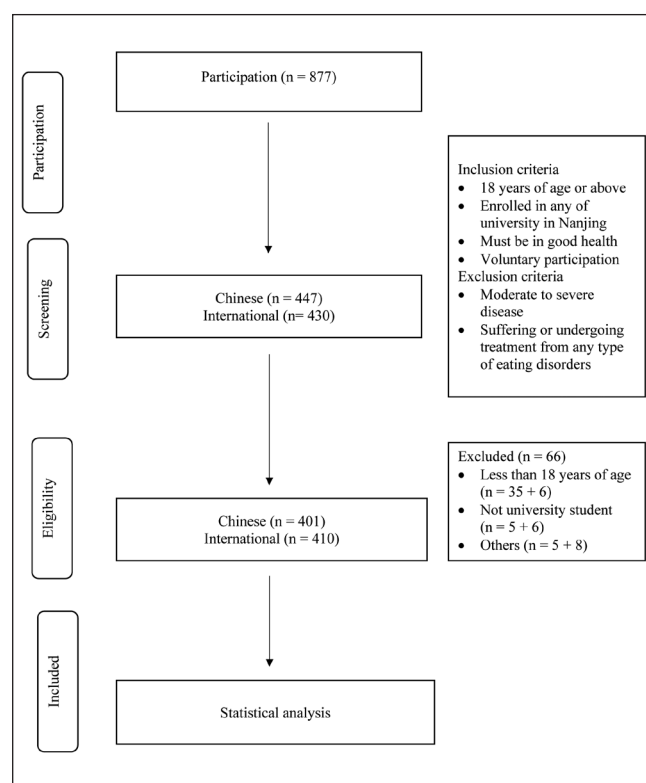


Fig. 1. Flow chart of study design.

and subscales are rated like a Likert method on the 0–6 scale, with higher scores results severity. Global scale is defined as elevated ED risks as EDE-Q  $\geq 4$ , as this value is described as a clinically positive cut-off value for EDs screening.

### Definitions of Objective Binge Eating and Compensatory Behaviour

*Objective binge eating (OBE)* was defined as a sense of loss of control over your eating with a response of more than four times (regular occurrence) over the past 28 days.

*Compensatory behaviour (CB)* was defined as self-induced vomiting, use of laxatives, fasting  $\geq 13$  days, and excessive exercise of  $\geq 20$  days to control shape and weight over the past 28 days.

### Ethical Approval

The study was approved by the Ethical Review Board of Nanjing Medical University under the Declaration of Helsinki (ID-2018320002).

### Statistical Analyses

Data were analysed by statistical software SPSS (version 22; SPSS Inc., Chicago, IL, USA). For sample characteristics, descriptive statistics were performed as n (%), mean  $\pm$  SD, and percentiles. To estimate the internal consistency and reliability

\*www.wjx.cn

of the questionnaire, Cronbach's  $\alpha$  coefficient was calculated. MANOVA and post-hoc analysis (Tukey's) were performed for the EDE-Q subscale scores among nationality and weight status. The Pearson's chi-square test found the prevalence and frequency of EDE-Q subscales. Binary logistic regression (odds ratios) was performed for each student's characteristics. Reference categories were set for characteristics of more than two categories, such as (age, gender, degree level, and BMI). All tests were performed at a 95% confidence interval ( $\alpha = 0.05$ ).

## RESULTS

### Internal Consistency

Internal consistency was assessed through Cronbach's  $\alpha$  coefficient, which was calculated at 0.89 for the Chinese global score (restraint 0.83, eating concern 0.81, shape concern 0.89, and weight concern 0.86) and 0.91 for the international global score (restraint 0.83, eating concern 0.81, shape concern 0.86 and weight concern 0.81).

### Sample Characteristics for International and Chinese Students

In our study, mostly Chinese undergraduate female students 18–25 years of age took part in the study compared to postgraduate international students who were mostly 26–35 years of age and had male gender. Overall, the participation of undergraduate female students was higher in this study. The prevalence of being underweight and obese (16.2% vs. 13.5%) was higher in Chinese students, while international students were more overweight (23.9%). There were more athletes in international students than Chinese students (21.5% vs. 1.7%). International students were physically active and more involved in extra-curricular activities as compared to Chinese students. Smoking and alcohol were more common among international students (14.1% vs. 7.1%). There was a statistically significant difference among age, gender, weight status, level of education, smoking, alcohol, athletes, physical activity, and extra-curricular activities ( $p$ -value  $< 0.05$ ) in both groups (Table 1).

### Mean Score for Subscales by Nationality and BMI Classification

International students showed significantly higher scores for ED subscales than Chinese students. Shape and weight concern scores were significantly higher in both Chinese and international students according to the linearly independent pairwise comparison. The global score for international students was significantly higher than that of Chinese students. BMI classification showed that normal-weight individuals (both Chinese and international) had more scores than underweight (Fig. 2).

### Proportion of Eating Disorder Behaviour

The regular occurrences of OBE, vomiting, laxative misuse, and excessive exercise were significantly higher in international students than in Chinese students (Table 2).

**Table 1.** General sample characteristics

Variables	Chinese (N=401) n (%)	International (N=410) n (%)	p-value
Age			
18~25	379 (94.5)	197 (48)	<0.001***
26~35	22 (5.5)	213 (51.9)	
Gender			
Male	131 (32.7)	250 (61.0)	<0.001***
Female	270 (67.3)	160 (39)	
Education			
Undergraduates	311 (77.6)	145 (35.4)	<0.001***
Postgraduates		170 (41.5)	
Doctoral	74 (18.5)	95 (23.2)	
BMI (kg/m <sup>2</sup> )			
Underweight	65 (16.2)	25 (6.1)	<0.001***
Healthy weight	245 (61.1)	255 (62.2)	
Overweight	37 (9.2)	98 (23.9)	
Obese	54 (13.5)	32 (7.8)	
Smoking			
Yes	16 (4.0)	58 (14.1)	<0.001***
No	385 (96.0)	352 (85.9)	
Alcohol			
Yes	22 (5.5)	29 (7.1)	0.070
No	379 (94.5)	381 (92.9)	
Physical activity			
Yes	174 (43.4)	243 (59.3)	<0.001***
No	227 (56.6)	167 (40.7)	
Extracurricular activities			
Yes	116 (28.9)	238 (58.0)	<0.001***
No	285 (71.1)	172 (42.0)	
Athlete			
Yes	7 (1.7)	88 (21.5)	<0.001***
No	394 (98.3)	322 (78.5)	

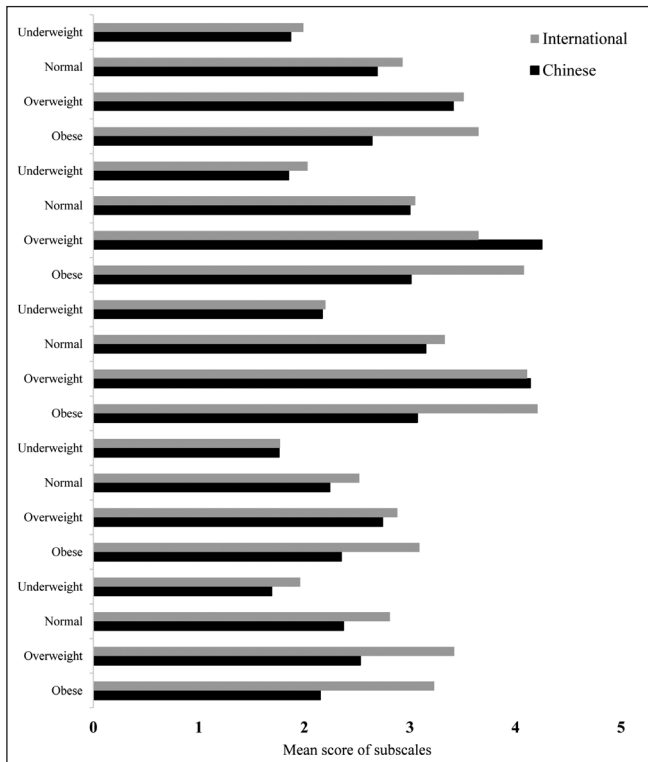
BMI categories: underweight – BMI  $< 18.50$ ; healthy weight – BMI = 18.5–24.9; overweight – BMI = 25–29.9; obese – BMI  $\geq 30.0$ .

\*\*\* $< 0.001$  (Chi-square test)

### Correlation of Eating Disorder Symptoms with Demographic Characteristics

*Age.* The adult Chinese (26–35 years of age) were more associated with slightly high odds of EDs risks, low odds of OBE and CB. International students are associated with elevated odds of EDs risks relative to older age, high odds of OBE and CB. International students are associated with elevated odds of EDs risks relative to older age and high odds of OBE and CB.

*Degree level.* In terms of degree level, Chinese undergraduates and postgraduates were likely to be elevated at EDs risks (OR=1.12, OR=1.23), OBE (OR=1.23), and CB (OR=1.23 and 0.42), respectively. International undergraduates and graduates were less likely to elevate EDs risks (OR=0.70, 0.64), OBE (OR=0.67, 0.80), and CB (OR=1.01, 0.89), respectively.



**Fig. 2.** Mean score of subscales of EDE-Q by BMI classification. BMI categories: underweight – BMI < 18.50; healthy weight – BMI = 18.5–24.9; overweight – BMI = 25–29.9; obese – BMI ≥ 30.0.; p-value: \*\*\* ≤ 0.001, \*\* ≤ 0.01, \* ≤ 0.05

**Gender.** Chinese female students were at statistically higher risk for EDs (OR = 1.93, p-value ≤ 0.01), OBE (OR = 1.38), and lower CB (0.77) while international female students were likely to have statistically significant higher EDs risk (OR = 1.52, p-value ≤ 0.05), OBE (OR = 1.01), and CB (0.68).

**Smoking.** Chinese students were more associated with EDs risk (OR = 1.63), OBE (OR = 1.62), and CB (OR = 1.60). International students show higher EDs risk (OR = 1.32), report less OBE (OR = 0.98), and statistically significantly lower risk for CB (OR = 0.49, p-value ≤ 0.05).

**Alcohol.** Chinese students were less likely associated with EDs risk (OR = 0.81), OBE (OR = 0.84), and CB (OR = 0.67), while

international students had a higher risk for EDs (OR = 1.80), lower OBE (OR = 0.78), and higher CB (OR = 1.53).

**Athletes.** Chinese students showed statistically significant associations with EDs risk (OR = 3.35) and lower CB (OR = 0.18). However, international students represented a significantly lower risk for EDs (OR = 0.44, p-value ≤ 0.001), lower OBE (OR = 0.77), and higher CB (OR = 1.28).

**BMI.** Chinese students of HBW relative to LBW had a significantly higher risk for EDs (OR = 3.68, p-value ≤ 0.001), OW (OR = 21.79, p-value ≤ 0.001), and OB (OR = 4.54, p-value ≤ 0.001). The risk for OBE (HBW: OR = 0.99), (OW: OR = 1.41), (OB: OR = 0.72), and CB (HBW: OR = 1.06), (OW: OR = 1.22), (OB: OR = 0.51). International students of HBW relative to LBW reported a significantly elevated risk for EDs (OR = 4.39, p-value ≤ 0.001), OW (OR = 7.77, p-value ≤ 0.001), and OB (OR = 13.42, p-value ≤ 0.001). The higher risk for OBE (HBW: OR = 1.60), (OW: OR = 2.33), (OB: OR = 1.64), and higher CB (HBW: OR = 9.24, p-value ≤ 0.001), (OW: OR = 9.79, p-value ≤ 0.001), (OB: OR = 5.49, p-value ≤ 0.001).

**Physical activity.** Chinese students were identified with high physical activity more associated with EDs risk (OR = 1.18), OBE (OR = 1.47), OBE (OR = 0.85), and higher CB (OR = 1.98, p-value ≤ 0.001).

**Extra-curricular activities.** Chinese students reported a statistically significant association with EDs risk (OR = 1.15), OBE (OR = 1.13), and lower CB (OR = 1.89, p-value ≤ 0.01). However, international students had a high risk for EDs (OR = 1.19), OBE (OR = 1.00), and CB (OR = 1.09) (Table 3).

## DISCUSSION

The EDE-Q is one of the most widely used tools in the field of public health to collect data and assess the core psychopathology, key behavioural features, and associated risks all over the world. This cross-sectional survey evaluated the prevalence of EDs among university students. Our findings suggested that EDs are significantly associated with young adults, female sex, higher BMI, athletes, higher physical activity, and more active extra-curricular students. Overall, international students (22.93 vs. 16.65%) reported more EDs symptoms than Chinese students;

**Table 2.** Proportion of Chinese and international students engaged in disordered eating behaviour

Any occurrence	Chinese (N = 401) n (%)	International (N = 410) n (%)	p-value
Objective bulimic episodes	326 (81.3)	300 (73.0)	0.002
Vomiting episodes	385 (96)	387 (94.0)	0.08
Laxative misuse episodes	382 (95.2)	355 (86.5)	<0.001
Excessive exercise	298 (74.3)	239 (58.3)	<0.001
Regular occurrence <sup>a</sup>			
Objective bulimic episodes	84 (20.9)	110 (26.8)	0.002
Vomiting episodes	25 (6.2)	23 (5.6)	0.08
Laxative misuse episodes	19 (4.7)	55 (13.4)	<0.001
Excessive exercise	103 (25.6)	171 (41.7)	<0.001

<sup>a</sup>Regular occurrence was defined as ≥ 4 occurrences, fasting ≥ 13 days, excessive exercise of ≥ 20 days over past 28 days

**Table 3. Bivariate correlates of eating disorder symptoms across student characteristics (binary outcome, by nationality)**

Variables	Chinese (N=401)			International (N=410)		
	EDE-Q≥4 OR (95% CI)	OBE OR (95% CI)	CB OR (95% CI)	EDE-Q≥4 OR (95% CI)	OBE OR (95% CI)	CB OR (95% CI)
Age						
18~25	1.26 (0.53, 3.01)	0.68 (0.26, 1.7)	0.83 (0.35, 1.9)	1.61 (0.81, 3.19)	1.70 (0.83, 3.4)	0.62 (0.31, 1.23)
26~35	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Degree level						
Undergraduates	1.12 (0.66, 1.87)	1.23 (0.68, 2.2)	1.23 (0.72, 2.0)	0.70 (0.34, 1.42)	0.67 (0.32, 1.3)	1.01 (0.49, 2.05)
Postgraduates	1.23 (0.48, 3.17)	–	0.42 (0.13, 1.3)	0.64 (0.38, 1.08)	0.80 (0.47, 1.3)	0.89 (0.52, 1.51)
Doctoral	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Gender						
Female	1.93 (1.19, 3.12)**	1.38 (0.81, 2.3)	0.77 (0.49, 1.2)	1.52 (1.02, 2.2)*	1.01 (0.67, 1.5)	0.68 (0.46, 1.01)
Male	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Smoking						
Yes	1.63 (0.56, 4.73)	1.62 (0.47, 5.6)	1.60 (0.52, 4.9)	1.32 (0.72, 2.39)	0.98 (0.52, 1.8)	0.49 (0.26, 0.9)*
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Alcohol						
Yes	0.81 (0.31, 2.09)	0.84 (0.30, 2.3)	0.67 (0.26, 1.7)	1.80 (0.84, 3.87)	0.78 (0.34, 1.7)	1.53 (0.69, 3.37)
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Athlete						
Yes	3.35 (0.86, 12.9)*	–	0.18 (0.22, 1.5)	0.44 (0.27, 0.74)**	0.77 (0.45, 1.3)	1.28 (0.77, 2.10)
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
BMI (kg/m <sup>2</sup> )						
Underweight	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Healthy weight	3.68 (2.08, 6.53)***	0.99 (0.60, 1.6)	1.06 (0.66, 1.7)	4.39 (1.83, 10.4)***	1.60 (0.70, 3.6)	9.24 (3.13, 27.3)***
Overweight	21.79 (9.17, 51.7)***	1.41 (0.62, 3.1)	1.22 (0.57, 2.63)	7.77 (3.04, 19.8)***	2.33 (0.96, 5.65)	9.79 (3.17, 30.19)***
Obese	4.54 (2.29, 8.99)***	0.72 (0.36, 1.46)	0.51 (0.26, 1.02)	13.42 (4.50, 40.05)	1.64 (0.58, 4.63)	5.49 (1.59, 18.90)**
Physical activity						
Yes	1.18 (0.82, 1.71)	0.84 (0.56, 1.26)	0.97 (0.67, 1.42)	1.47 (1.00, 2.15)	0.85 (0.57, 1.26)	1.98 (1.35, 2.90)***
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Extracurricular activities						
Yes	1.15 (0.76, 2.09)	1.13 (0.71, 1.79)	1.89 (1.25, 2.85)**	1.19 (0.82, 1.73)	1.00 (0.68, 1.47)	1.09 (0.74, 1.59)
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

These values are odds ratios from logistic regression with 95% confidence interval in parentheses. OBE – objective binge eating; EDE-Q≥4 – elevated disorder risk; CB – any compensatory behaviours over 28 days; p-value \*\*\*≤ 0.001, \*\*≤ 0.01, \*≤ 0.05

these results were in line with international studies carried out in Malaysia and three different countries of Europe (Hungary, Poland and Ukraine) (20, 21). Previously, lower nutritional KAP scores were reported for international students in China as compared to other Chinese students (22).

Based on EDE-Q subscales, both Chinese and international students presented higher scores for shape and weight concern; they likely have a desire for a flat stomach, dissatisfaction with their shape and weight, and fear of weight gain. Epidemiological studies in China have also reported similar findings with elevated scores for shape and weight concern (23, 24). Of note, the global score for both was almost equivalent, alarming the severity of symptoms. There are several possibilities, but we firmly believe that this heightened shape and weight concern occurred due to globalization's influence and western attitude as

China modernized (25). The other possible reasons might be the change in dietary habits and lifestyle over the decades (22). For international students, ethnicity or racial differences might be the influential factors. One of the studies found a strong association between disordered eating patterns and cultural adaptation (26). Another study also elucidated the similar findings of eating disorder symptoms with acculturation stress as well as investment in appearance ideals (27).

Students of higher education particularly university students had the highest prevalence rate which is increasing gradually (28). Consistent with our findings, a cohort study has been conducted in China showing young adults of both genders increasingly developing EDs (29). We found that undergraduates of 18~25 years were at more risk for EDs than older age in both Chinese and international students; however, the risk for EDs behaviour

was 1.6 times higher among international students. The possible reason may be the rapid advancement, idealism and vast media involvement as many studies suggested that media plays an important key role in the cause of EDs (15). Depiction of personal appearance, pressure, and complained of disordered eating and dissatisfaction of the body are endorsed by media and young ones are more attracted towards this (14, 30).

ED could be present in both males and females, however, the proportion of males with EDs were smaller than females in many previous studies (7, 20). Most studies carried out in China were based on gender differences, only accounting young university females into the study for EDs and the higher risk was found in females according to the latest China Health and Nutrition Survey (17). This survey also revealed concomitant association for EDs for BMI like our research, the higher association of EDs, OBE, CB in higher BMI status (17) but in the aforementioned survey participants were only Chinese females. We found similar findings of prevalence of EDs among females. BMI seems to be a key factor in referring to risky dietary habits. It was confirmed in our study that both Chinese and international students showed 7–21 times higher risk for EDs among overweight and obese students similar to previously performed survey in Europe (20, 31). The possible reason for this was an association of obesity and EDs psychopathology and had been explained earlier in many findings (21, 32).

Alcohol, cigarette smoking and other such bad habits were more common in people with EDs as compared to the general population (33). Smoking was reported as one of the risk factors among Chinese students in our study but had the negative association with international students. There are various studies reported in which smoking was highly prevalent with EDs, and a meta-analysis study testified that people with eating disorders were prevalent to life-time smoking (10). Similar findings were observed in the USA where young American adults with self-reported EDs had higher use of e-cigarettes (34). Athletes, higher physical activity, and extra-curricular activities showed significant higher risks for EDs among students which might be due to muscular-oriented concept which is evolving EDs psychopathology nowadays among athletes and other physically active individuals (35, 36). Furthermore, various findings suggested that performance pressure and body weight on college athletes were high-risk factors for EDs (37, 38).

According to our best knowledge, this is the only study in which international and local students studying in various universities of Nanjing were assessed for EDs. This study also highlighted the importance of good nutritional and psychiatric health among students as a university is considered an ideal place for learning. This study helped us understand that both genders are equally important in addressing this sensitive issue. Most importantly, the number of international students is increasing. Therefore, their proper assessment is necessary to cope with the sudden burden of the EDs.

This study presents some limitations because it was conducted through online software, and the possibility of bias can occur from students for information/recall. A second stage study based on an interview should be conducted to assess the clinical symptoms of EDs. Furthermore, this study collected data for a very limited time (past twenty-eight days from each participant), that is why a cohort or follow-up study should be conducted to measure the potential risk factors for EDs. Most importantly, participating

students were not diagnosed with EDs in the past. Other limitations regarding socio-demographic factors such as working time in postgraduate students and parenthood could influence EDs symptomology. The difference in age groups between both samples could limit the results.

## CONCLUSION

Conclusively, there was a higher risk of EDs in international students than in local Chinese students. EDs had striking associations with the following characteristics: female sex, young adults, higher BMI, athletes, and students with higher physical and extra-curricular activities. Education and assessment about EDs is necessary for university students despite gender and nationality differences. Moreover, this quest will support public health professionals in better understanding and implementing policies and well-organized interventions for healthier wellbeing among university students, ultimately bring academic performance to an optimum level.

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## Conflict of Interests

None declared

## Authors' Contribution

QF and AY planned, analysed, and reported the work described in the article and was responsible for the overall content as guarantor. FM and IM took the participation in data collection and SH, HS and HK helped with statistical revision. IH, OH were involved in manuscript revising.

## Electronic Supplementary Material

This article contains supplementary material (Figure S1 – prevalence of ED among males and females, Figure S2 – prevalence among Chinese and international students) available at <https://doi.org/10.21101/cejph.b0145>.

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