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Factors Associated with being Overweight among Inner Mongolia Medical Students in China

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Article summary

Article Focus

1. Identify lifestyle factors associated with overweight in a specific population of medical students.
2. Whether being an only child is one of the determinants of overweight.

Key Messages

1. Being an only child is just one of the determinants with location of residence also being important.
2. Skipping breakfast increase the risk of being overweight. Although smoking is not a direct factor, it might indirectly affect sleeping quality, skipping breakfast, and not actively exercising, which might increase the risk of being overweight risk.
3. Being overweight leads to less physical activities and poor physical fitness, which in turn increases the risk of being overweight.

Strengths and Limitations

Lifestyle data were assessed on the basis of self-reported data only, without the use of experimental measurements. In contrast, the response rate and large number of participants are strengths of the study.

Abstract

Objectives: a major goal of our study was to identify the associations between lifestyle factors and obesity in adolescents and young adults at risk by surveying students in Inner Mongolia Medical University. A second goal was to determine these factors differed by gender.

Design: Cross-sectional study

Setting: Students grade 1 to 3 in Inner Mongolia Medical University

Participants: 5471 grade 1-3 medical students, composed of 3891 females and 1580 males. Students BMI ≥25 was defined as overweight.

Results: BMI for males was 22.1 ±2.9 and 21.2 ±2.2 for females. The prevalence of overweight was 7.6%, with the prevalence being higher for males compared to females, urban higher than rural, and being an only child higher than having sibling children. For males, urban residence was a risk factor, while for females being an only child and staying up at night were risk factors, with physical activity a protective factor. A dose-dependency relationship was found between physical fitness and overweight prevalence.

Conclusions: This study shows that being an only child and resident in an urban area are risk factors, staying up late and lack of physical activities increased the risk of being overweight. BMI was associated with declines in physical fitness. Our study provides more insight into adolescent obesity problems.

Introduction

Obesity has increased globally among children, adolescents, and adults, worldwide, at least 2.8 million people die each year as a result of being overweight or obese with mortality rates proportional to degree of obesity [1]. Younger age groups are affected as demonstrated in the example of American college students of whom nearly 1/3 are overweight or obese [2]. According to the WHO, in Europe, some 30-80% of adults and about 20% of children and adolescents are overweight [3]. The situation in Asia is better with lower prevalence of obesity reported in Japan [4], Thailand [5], and China [6] although China is experiencing a rapid increase in the numbers of people classified as overweight or obese.

With obesity becoming an overwhelming global public health issue multitude of diseases associated with it, including heart diseases, diabetes, hypertension, and certain cancers . Although obesity is less prominently associated with morbidity in adolescence [7] it is, nevertheless, a strong precursor of obesity and related morbidity in adulthood [8]. Adolescence has been identified as a critical period in the development of overweight/obesity patterns [9] with the transition to college another potentially important time of risk for increases in weight among young adults [10]. In China, obesity is on the rise [6] with the prevalence of being overweight or obese increasing from 9.6 and 0.6%, respectively, in 1991 to 20.0 and 3.0%, respectively, in 2000 among men; for women the comparable figures showed an increase from 14.5 and 1.8%, respectively, to 26.5 and 5.2%, respectively [11].

The causes of obesity among children and adolescents can be divided into genetic factors [12] and lifestyle factors, which include patterns of physical activity and diet [13]. Lifestyle is the most important factor in childhood and adolescence with some studies

showing that markers of an unhealthy lifestyle, such as inactivity and skipping breakfast are related to overweight and obesity. However, findings are not consistent among studies, due to differences in variables such as sex, race, and region. In addition, the proportion of one-child families rising, a situation more prevalent in China since the 1970s, with the advent of family-planning policy.

Associations between lifestyle and overweight have not been studied in the Inner Mongolia Autonomous Region of China, a minority centralized residence area. Consequently, a major goal of our study was to identify the associations between lifestyle factors and obesity in adolescents and young adults at risk by surveying students in Inner Mongolia Medical University. A second goal was to determine these factors differed by gender.

Methods

Participants

A cross-sectional survey [14] was conducted among medical students at the Inner Mongolia Medical University of China. The survey employed a self-administered questionnaire (Supplementary File 1).

In terms of ethnicity, we three categories: Han, Mongolian (the minority), and other. Participants' ethnicity information came from basic information contained in the school database.

Physical Fitness Test Data

Physical fitness test data were obtained from the school's sports department and included height, weight, speed, flexibility, vital capacity, and endurance score data. We used height and weight to compute body mass index (BMI, kg/m^2) employing the WHO 2007

reference for categories: <18.5: underweight; 18.5-24.9: normal weight; ≥25: overweight, with BMI ≥30 considered obese. Speed score was measured by the 100 meters run; flexibility by sit-and-reach; vital capacity by a vital capacity meter; and endurance by a 800 m run for females and 1 km run for males. Speed and endurance are conducted outside on a running track other items test in an established room.

Survey Data

The data were collected from December 2010 to January 2011 for 5471 grade 1-3 medical students, composed of 3891 females and 1580 males.

The survey was carried out in the classroom. In cooperation with faculty management, students were informed about the purposes of the study. They were assured of confidentiality and voluntary participation.

Investigators distributed questionnaires and asked students to complete the questionnaires in the classroom. Participants returned the completed questionnaire to investigators some of whom checked the questionnaire while others counted the number of questionnaires. Finally, investigators put questionnaires in a sealed envelope [14].

The self-report questionnaire contained inquiries about basic information including student ID, sex, ethnicity, living habits, and feelings experienced during time in college [14, 15, 16]. In the questionnaire, the following definitions were used: students who used to reside in cities or suburbs were classified as urban, while those previously residing in villages or pastoral areas were classified rural; only child was defined a person without siblings; We defined breakfast followed our previously research[17] which is any food or beverage consumption between awakening and 45 minutes after the start of school. Subjects who did

not consume breakfast on one of two days or neither day were categorized as breakfast skippers, while those that consumed breakfast on both days were classified as breakfast eaters [18], a sports participant was defined as a person who did sports at least 1 hour per week; staying up was defined as going to bed after midnight; a smoker was defined as a current daily smokers or occasional smoker [14]. Gastrointestinal problems were defined as recurring symptoms that were significant enough to alter lifestyle or require chronic treatment[19] and quality of relationships (poor, medium, good) were self-assessed.

Statistical analysis

Quantitative data were inputted using EpiDate v3.1 and analyzed using SPSS v.13.0.

After computing mean BMI and prevalence of being overweight by gender the mean study BMI was compared with national Chinese figures using a t test. The prevalence of being overweight was then calculated using the previously enumerated lifestyle factors. Next, crude odds ratios (OR) were calculated to evaluate the risk of exposure effects in the group under study relative to the reference group and associated 95% confidence intervals (CI). A non-conditional binary logistic regression analysis was used to ascertain factors associated with being overweight. This method was used for analyses with dependent variables in two categories (in this case, overweight and normal weight). Independent variables included the enumerated lifestyle and other factors. Adjusted OR used logistic regression models to explore the relationship between the independent variables on the dependent variable in model. In the models an OR >1.0 designated increased overweight risk and OR <1.0 indicated protective factors. An independent-sample t test was used to compare physical scores in overweight vs. normal weight groups by gender. The trend chi-square test was used

to ascertain any dose-dependent relationships between the prevalence of being overweight and physical fitness by gender.

A significance level of $p = 0.05$ was accepted for all analysis.

Results

Sample Characteristics

There are 5673 grade 1-3 registered students in the school, 5471 (96.44%) student in school complete our survey. 1580 were male and 3891 female. The mean age of the participants was 21.0 ± 1.4 years.

BMI and prevalence of being overweight or Obese

The BMI for males was 22.1 ±2.9, and for females 21.2 ±2.2. On average, the males had a higher BMI than did the female.

The overall prevalence of being overweight among Inner Mongolia medical students was 7.6% in which over 13% of the students were obese (Table 1). The prevalence of being overweight among males was significantly higher than among female (13.6% vs. 5.1%). The prevalence of being overweight prevalence in male students who were prior urban residents was nearly twice those who were prior rural residents and in those who were only children the prevalence was also higher. The prevalence of being overweight in female who were only children was nearly twice those who were not, nearly 50% higher in female who were prior urban residents compared to prior rural residents. In prior urban resident students, the prevalence of being overweight for only children was 12.5% vs. 7.8% for those with siblings. For prior rural students, the pattern was similar but of lower overall prevalence: 8.8% vs. 5.8%. In male students, the prevalence was substantially higher compared to females when

looking at urban vs. rural and then only children vs. children with siblings: 21.2% vs. 15.8%, and 11.5% vs. 10.6% (males); 8.4% vs. 5.2%, and 5.8% vs. 4.3%, respectively.

Overweight-related lifestyle habits

Students who skipping breakfast had a 50% higher prevalence of being overweight compared to their breakfast-eating counterparts. Similarly those students who were smokers or stayed up late had nearly double the prevalence of being overweight (Table 2).

Factors associated with being overweight

Students who were prior urban residents were also at higher risk for being overweight. Although male students who were only children or stayed up late were at higher risk for being overweight in the univariate analysis, there was no difference in the multivariate analysis(Table 3).

For female medical students, compared with those who had siblings, only children had nearly 1.5 times higher risk of being overweight; staying up late also was also associated with a similar level of risk. However, unlike males, participating in sports for females was protective. While there was a significantly higher risk of being overweight with higher monthly expenses in the univariate analysis this risk became non-significant in multivariate analysis.

Physical fitness in overweight and normal weight students

The physical score of normal weight and overweight students was compared in male and female respectively (Table 4). A reduced physical score was found for all items in males and 3 items (speed, vital capacity, and endurance) in females. The highest reduction between normal weight and overweight subjects was found in vital capacity.

Dose-dependency relationship between overweight prevalence and physical fitness score

In analyzing the associations between physical fitness score and the prevalence of being overweight we found that as physical fitness score increased, the prevalence of being overweight decreased in the categories of speed, vital capacity, and endurance (Table 5). This suggests a dose–dependency relationship between physical fitness and the prevalence of being overweight. However, we did not find this trend in regard to flexibility for both genders.

Discussion

While many studies have reported that factors of residency type, lifestyle factors are associated with adolescent obesity, results are not always consistent, so we carried out a survey to explore whether these factors constituted a risk for being overweight in our university students.

Our study shows that the prevalence of being overweight is 7.6%. This is considerably lower compared to the reported prevalence among the Chinese population in general [20], but higher than Chinese college students (4.1%) [21]. At the same time, compared with other reports of college students in the USA [22] and European countries such as Greece [23], the prevalence of being overweight in the current study is still lower.

Consistent with other research [2, 5], males in our study had a significantly higher mean BMI than females, although values were considerably lower compared with college students in the USA [2] but higher than the Thailand students [5]. Our results suggest that male students had a significantly higher prevalence of being overweight than those female students. This finding is consistent with recently reported data [2, 15]. The higher prevalence of

overweight and obesity among males may be partially due to the fact that male students are usually satisfied with their weight and body image in addition to bulking up and increasing muscle/weight gain[2]. Thus, college females are more likely to perceive themselves to be overweight and will more often attempt to lose weight [24]. These factors may explain the gender discrepancy in BMI prevalence.

The results of the current study also provide some support for the type of residency being important in relation to being overweight. Numerous studies have reported that adolescents who reside in urban areas have a higher risk of being overweight. For example, in a Thailand [25]. Conversely, authors of a Canadian study reported that there was a trend for increasing being overweight or obese among adolescents as the degree of living in a rural area increased [26]. Over the past 3 decades, China has enjoyed economic development and the population have experienced changes in lifestyle. Reductions in physical activity and labor intensity in both urban and rural areas have been observed, and in 2010, the prevalence of being overweight or obese in males was higher than females and higher for residents of urban compared to rural areas [27]. This result appears to originate in cultural attitudes and beliefs. Thus, for urban students there is the perception that the pursuit of academic excellence has greater status than physical activity. Normally, parents encourage their children to engage in educational and spiritual activities rather than leisure time physical activities, but rural students are additionally expected to take part in some of the farming activities that are physically demanding [28].

Since the advent of the family planning policy in China, children without siblings—only children—as a group, have become more numerous, especially in urban areas. In our study,

univariate analysis showed only children also have higher risk of being overweight in both male and females, but in multivariate analysis the difference disappeared in males. In one study it was noted that actual differences in percentage terms are not great between only and sibling children and the significant differences almost always disappear after adjustment [29]. The interpretation is that while family size per se is not important, residence, parental education, and gender are the key determinants. Thus, although only children are 3 times to be overweight as a group compared to sibling children, there is no difference after controlling for residence type and gender. In other words, it is a problem primarily of urban males in this population. However, in our study we found that female only children were still more likely to be overweight even after adjustment. Thus, our study shows that being an only child is just one of the determinants with location of residence also being important. This could be because the only child always lives under more favorable conditions, yet children in an urban family also benefit compare to their rural counterparts.

Besides the aforementioned factors we also investigated other lifestyle factors, including staying up late, which is associated with quality of sleep, smoking, physical activity, and skipping breakfast. Our results showed that after adjustment, for females participating in sports activities was a protective factor while staying up late at night increased the risk of being overweight. Noland et al also reported that students who received fewer hours of sleep were significantly more likely to be overweight [30] and other researchers have found that hat shorter sleep periods are associated with decreased leptin levels, increased ghrelin levels, and increased hunger and appetite [31, 32]. While we did not find that skipping breakfast was a significant factor in our students, Maddah reported that skipping breakfast is one potential

risk factor for overweight/obesity in both urban and rural girls in Iran [33]. In general, it is thought that overweight students have less satisfactory breakfast habits than normal weight students and while this might be a reflection of the whole diet being less than adequate, an inadequate breakfast could contribute to the making of poor food choices over the rest of the day, leading in the long term to an increased risk of obesity [34]. Other investigators have noted that beneficial effects on cognitive performance do occur in the late postprandial period [35], and so skipping breakfast could reduce the efficiency of daily study. If students have to then stay up late to finish work, a vicious circle could ensue.

Our results show that smoking was not significant. Research is not consistent regarding whether smoking increases the risk of obesity. One study reported that smoke, whether by active smoking or exposure to environmental smoke, was associated with at least a 4-fold increase in the risk of the metabolic syndrome among adolescents who were overweight and at risk for being overweight [36]. Conversely, another investigation demonstrated that current smokers were less likely to be significantly overweight than former smokers or those who never smoked. What is of interest is that compared with nonsmokers, smokers are more likely to sleep fewer than 6 hours per night, skip breakfast, and not actively exercise [37]. This leads us to speculate that although smoking is not a direct factor, it might indirectly affect sleeping quality, skipping breakfast, and not actively exercising, which might increase the risk of being overweight risk.

Although lack of physical activity increases the risk of obesity, being overweight also is associated with poor physical fitness. We found that overweight adolescents generally had poorer physical fitness than their normal weight counterparts. This result is in agreement with

our previous medical student study [15]. In the study reported here, overweight students have lower speed, endurance, and vital capacity, a finding similar to another investigation in which it was concluded that being overweight reduced cardiorespiratory fitness and speed compared with normal weight Chinese children [38]. Regarding flexibility, we found no difference between overweight and normal weight students. This is in line with a Taiwanese study [39] but at odds with a Western report in which slightly better sit-and-reach results were achieved by overweight compared to normal weight girls [40]. Flexibility, therefore, seems to be consistently less influenced by body weight.

A dose-dependency relationship was found in our study, with increased physical fitness score while the prevalence of being overweight declined. Authors of another Chinese study reported that obese children are less mobile and less self-confident , which makes them participate in less physical activities, putting them at risk for chronic disease [38]. Again, this pattern suggests a vicious circle: being overweight leads to less physical activities and poor physical fitness, which in turn increases the risk of being overweight.

While medical students might have knowledge regarding the consequences of inappropriate body weight, a substantial number ignore this knowledge. School administrators should encourage students to actively participate in body weight training and education to improve attitudes toward inappropriate body weight, to increase protective factors, and reduce the risk factors for inappropriate body weight, especially in only children.

There are limitations to this study. Lifestyle data were assessed on the basis of self-reported data only, without the use of experimental measurements. In contrast, the response rate and large number of participants are strengths of the study.

Table 1. Prevalence of being overweight by gender, Inner Mongolia Medical University

Characteristic	Male		Female		Total	
	n	%	n	%	n	%
Year of study (grade)						
1	577	11.8	1785	5.5	2362	7.1
2	589	13.6	1290	5.0	1879	7.7
3	414	16.2	816	4.4	1230	8.4
Ethnic						
Han	1145	14.4	2798	4.8	3943	7.6
Mongolian	349	11.5	926	5.8	1275	7.4
Other	86	11.6	167	7.2	253	8.7
Resident						
Urban	642	18.2	1567	6.5	2209	9.9
Rural	931	10.3	2311	4.1	3242	5.9
Only children						
Yes	708	16.4	1158	7.2	1866	10.7
No	868	11.4	2728	4.2	3596	6.0

Table 2. Prevalence of being overweight in regard to lifestyle factors.

Category	n	Prevalence Overweight (%)
Monthly expenses		
<300 yuan	418	5.0
300-600 yuan	2678	6.3
600-1000 yuan	1764	10.5
>1000 yuan	244	14.8
Eating breakfast		
No (skipping)	1450	10.8
Yes	3661	7.0
Gastrointestinal problems		
No	4363	8.4
Yes	660	6.7
Sports participant		
No	2747	8.8
Yes	2360	7.2
Smoker		
No	4644	7.7
Yes	471	12.1
Staying up late		
No	4190	7.1
Yes	923	12.5
Quality of relationships		
Poor	114	7.9
Medium	2910	7.7
Good	2075.0	8.6

Table 3. Univariate (crude OR) and multivariate (adjusted OR) logistic regression analysis of being overweight by gender.

Factor	Male						Female					
	Crude			Adjusted			Crude			Adjusted		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Grade												
1	1.00			1.00			1.00			1.00		
2	1.16	0.82	1.64	1.09	0.75	1.59	0.89	0.65	1.24	0.83	0.59	1.16
3	1.47	1.02	2.12	1.48	1.00	2.19	0.82	0.55	1.21	0.81	0.54	1.21
Ethnicity												
Han	1.00			1.00			1.00					
Mongolian	0.77	0.54	1.12	0.79	0.53	1.18	1.23	0.89	1.70	1.22	0.87	1.71
Other	0.78	0.39	1.54	0.66	0.32	1.37	1.56	0.85	2.89	1.55	0.83	2.90
Residential												
Rural	1.00						1.00			1.00		
Urban	1.96	1.46	2.62	1.63	1.17	2.28	1.64	1.23	2.19	1.24	0.87	1.78
Only children												
No	1.00			1.00			1.00			1.00		

Yes	1.54	1.15	2.06	1.11	0.80	1.55	1.79	1.34	2.40	1.49	1.05	2.11
Monthly expenses												
<300 yuan	1.00			1.00			1.00			1.00		
300-600 yuan	0.91	0.40	2.08	0.77	0.33	1.80	1.26	0.71	2.23	1.24	0.68	2.26
600-1000 yuan	1.66	0.74	3.73	1.17	0.50	2.71	1.69	0.94	3.03	1.41	0.75	2.68
>1000 yuan	2.00	0.80	5.03	1.33	0.51	3.49	2.89	1.36	6.16	2.07	0.91	4.72
Eating Breakfast												
No (skipping)	1.00			1.00			1.00			1.00		
Yes	0.75	0.56	1.00	0.89	0.64	1.23	0.78	0.56	1.07	0.81	0.57	1.14
Gastrointestinal problems												
No	1.00			1.00			1.00			1.00		
Yes	0.81	0.50	1.31	0.79	0.48	1.30	0.82	0.59	1.29	0.82	0.52	1.29
Sports participant												
No	1.00			1.00			1.00			1.00		
Yes	0.80	0.59	1.08	0.87	0.63	1.21	0.83	0.72	0.94	0.93	0.84	0.99
Smoker												

No	1.00			1.00			1.00			1.00		
Yes	0.80	0.57	1.11	0.78	0.55	1.11	1.85	0.73	4.70	1.63	0.63	4.21
Stay up												
no	1.00			1.00			1.00			1.00		
yes	1.39	1.02	1.90	1.25	0.90	1.74	1.74	1.22	2.473	1.48	1.02	2.15
Relationship quality												
Poor	1.00			1.00			1.00			1.00		
Medium	6.21	0.84	45.69	5.78	0.78	43.12	0.49	0.23	1.03	0.42	0.19	0.90
Good	6.51	0.88	47.98	6.16	0.83	46.05	0.48	0.22	1.04	0.36	0.17	0.80

Table 4 Comparison of physical score between normal weight and overweight by gender.

Gender	Item	Normal Weight	Overweight	P
	Speed	64.8 ±0.6	50.9 ±1.8	0.000
Male	Vital capacity	66.5 ±0.5	37.1 ±1.7	0.000
(mean ±SE)	Endurance	70.5 ±0.6	59.3 ±1.6	0.000
	Flexibility	86.2 ±0.3	83.7 ±0.9	0.007
	Speed	62.0 ±0.3	54.9 ±1.6	0.000
Female	Vital capacity	64.7 ±0.3	46.1 ±1.6	0.000
(mean ±SE)	Endurance	73.3 ±0.3	67.8 ±1.2	0.039
	Flexibility	92.9 ±0.2	93.0 ±0.7	0.951

Table 5. Trend chi-square test between physical fitness score and overweight prevalence by gender.

Gender	Item	Score (Prevalence)					P
		<60	60-69	70-79	80-89	90-100	
Male	Vital capacity	323 (40.2)	563 (10.5)	307 (2.3)	142 (1.4)	119 (0.8)	0.000
	Endurance	190 (28.5)	480 (17.7)	366 (11.5)	195 (7.7)	223 (3.6)	0.000
	Flexibility	10 (20.0)	149 (20.8)	300 (13.7)	344 (11.6)	651(13.1)	0.051
	Speed	284 (27.5)	656 (13.6)	243 (7.4)	144 (5.6)	127 (4.7)	0.000
Female	Vital capacity	638 (14.6)	1612 (5.0)	721 (1.5)	296 (0.7)	276 (0.7)	0.000
	Endurance	210 (9.5)	1258 (7.1)	867 (4.4)	612 (3.9)	596 (2.9)	0 .000
	Flexibility	6 (0.0)	87 (2.3)	291 (6.2)	654 (5.8)	2505 (5.2)	0.944
	Speed	697 (7.6)	1687 (6.1)	783 (2.9)	262 (2.3)	114 (1.6)	0.000

Ethical approval

Ethical Approval to conduct the study in which consent was needed from all study participants was obtained from the Ethical Committee of Inner Mongolia.

Conflicts of interest statement

The authors declare that they have no competing interests.

Sharing statement

There is no additional data available.

Contributorship

JC, ZL, JB and JS designed the study, acquired and analysed the data, and prepared the manuscript. JS and ZL helped in the analysis and interpretation of data. YE, MD and WC supervised the study.

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Supplementary File 1: The questionnaire about College students' behavior and health

Student ID: _____

1. **Gender :**

   1) Male 2) Female

2. **Age: _____years**

3. **Ethnicity :**

   1) 1) Han 2) Mongolian 3) Other

4. **Class years of education :**

   1) 1 2) 2 3) 3 4) 4 5) 5

5. **Monthly expenses (Yuan) :**

   1) <300 2) 300-600 3) 600-1000 4) >1000

6. **Residence :**

   1) City 2) Rural 3) Pastoral 4) Suburbs

7. **Faculty :**

   1) Clinical Medicine

   2) Public Administration and Information Management

   3) Medicine

   4) Nurse

   5) Traditional Chinese Medicine and Mongolian Medicine

   6) Other

8. **Did you have breakfast :**

   1) Yes 2) No (skipping breakfast)

9. **Gastrointestinal upset:**

   1)Yes 2)No

10. **How about your relationships:**

    1) Good 2) Medium 3) Poor

The 11-18 questions only answered by smokers

11. Number of cigarettes smoked per day :

1) <5 2) 5–9 3) >10

12. Number of smoking friends :

1) <5 2) 5–10 3) >10

13. Parent smoker :

1) Yes 2) No

14. Quit smoking (times) :

1) Never 2) 1–2 3) >3

15. The first time smoking :

1) University 2) High School 3) Junior high school

16. The attitude of your family on you smoking :

1) Opposed 2) Don't Care 3) Approve

17. An hour not smoking :

1) No discomfort 2) Can endure 3) Intolerable

18. You feel after smoking :

1) Better 2) Worse 3) No change

For the 19-35 questions, please answer "Yes" or "No" to express your opinion

19. Do not care about people smoking around you :

1) Yes 2) No

20. Smoking is a sign of civilization :

1) Yes 2) No

21. Smoking is one of the causes of air pollution :

1) Yes 2) No

22. Teachers should not smoke:

1) Yes 2) No

23. The State should take measures to stop smoking :

1) Yes 2) No

24. Eliminate smoking on campus :

1) Yes 2) No

25. Eliminate smoking in classroom :

1) Yes 2) No

26. Smoking is harmful to one's health :

1) Yes 2) No

27. Smoking is harmful to the health of others :

1) Yes 2) No

28. You is the only one child in your family:

1)Yes (only children) 2)No (sibling children)

29. You do sports at least one hour once a week:

1) Yes 2)No

30. Did you go to bed after 00:00 in the last week

1) Yes 2)No

31. Feeling stress:

1) Yes 2)No

32. I find myself very concerned about the grades I am likely to receive this semester:

1)Yes 2)No

33. I am spending a lot of time thinking about how this semester's grades could negatively affect my educational and career goals:

1)Yes 2)No

34. I am worrying a great deal about the effect this semester's grades will have on my future

1)Yes 2)No

35. I find myself very concerned about the grades I am likely to receive this semester

1)Yes 2)No

Definition:

1. Smoke: Smoked every day in the last 30 days

2. Urban: Come from city or suburb

3. Rural: Come from from village or pastoral area

4. Stay up: staying up was defined as going to bed after midnight

5. Gastrointestinal problems were defined as recurring symptoms that were significant enough to alter lifestyle or require chronic treatment

6. Stress: Occurs when an individual perceives that environmental demands tax or exceed his or her adaptive capacity.

7. We defined breakfast per the Student Nutrition Dietary Assessment, which is any food or beverage consumption between awakening and 45 minutes after the start of school. Subjects who did not consume breakfast on one of two days or neither day were categorized as breakfast skippers, while those that consumed breakfast on both days were classified as breakfast eaters.

Research checklist STROBE Statement

	Item No	Recommendation
Title and abstract	1	(*a*) Factors Associated with being Overweight among Inner Mongolia Medical Students in China: A Cross-sectional Questionnaire Survey
		(*b*) Background: Although many studies have investigated factors that affect obesity, in China the data for particular occupations are limited, and thus the goal of this study was to identify lifestyle factors associated with overweight in a specific population of medical students. Methods: A survey was conducted among medical students at the Inner Mongolia Medical University of China. The material consisted of three parts: students' basic information, lifestyle of students, and physical fitness data. Students BMI ≥25 was defined as overweight. Factors associated with overweight were identified using binary logistic regression analysis. Results: BMI for males was 22.1 ±2.9 and 21.2 ±2.2 for females. The prevalence of overweight was 7.6%, with the prevalence being higher for males compared to females, urban higher than rural, and being an only child higher than having sibling children. For males, urban residence was a risk factor, while for females being an only child and staying up at night were risk factors, with physical activity a protective factor. A dose-dependency relationship was found between physical fitness and overweight prevalence. Conclusions: This study shows that being an only child and resident in an urban area are risk factors, staying up late and lack of physical activities increased the risk of being overweight. BMI was associated with declines in physical fitness. Our study provides more insight into adolescent obesity problems.
Introduction		
Background/rationale	2	Obesity has increased globally among children, adolescents, and adults, worldwide, at least 2.8 million people die each year as a result of being overweight or obese with mortality rates proportional to degree of obesity. Younger age groups are affected as demonstrated in the example of American college students of whom nearly 1/3 are overweight or obese. According to the WHO, in Europe, some 30-80% of adults and about 20% of children and adolescents are overweight. The situation in Asia is better with lower prevalence of obesity reported in Japan, Thailand, and China although China is experiencing a rapid increase in the numbers of people classified as overweight or obese. With obesity becoming an overwhelming global public health issue multitude of diseases associated with it, including heart diseases, diabetes, hypertension, and certain cancers . Although obesity is less prominently associated with morbidity in adolescence it is, nevertheless, a strong precursor of obesity and related morbidity in adulthood. Adolescence has been identified as a critical period in the development of overweight/obesity patterns with the transition to college another potentially important time of risk for increases in weight among young adults. In China, obesity is on the rise with the prevalence of being overweight or obese increasing from 9.6 and 0.6%, respectively, in 1991 to 20.0 and 3.0%, respectively, in 2000 among men; for women the comparable figures showed an increase from 14.5 and 1.8%, respectively, to 26.5 and 5.2%, respectively. The causes of obesity among children and adolescents can be divided into genetic factors and lifestyle factors, which include patterns of physical activity and diet. Lifestyle is the most important factor in childhood and adolescence with some studies showing that markers of an unhealthy lifestyle, such as inactivity and skipping

		breakfast are related to overweight and obesity. However, findings are not consistent among studies, due to differences in variables such as sex, race, and region. In addition, the proportion of one-child families rising, a situation more prevalent in China since the 1970s, with the advent of family-planning policy.
Objectives	3	Associations between lifestyle and overweight have not been studied in the Inner Mongolia Autonomous Region of China, a minority centralized residence area. Consequently, a major goal of our study was to identify the associations between lifestyle factors and obesity in adolescents and young adults at risk by surveying students in Inner Mongolia Medical University. A second goal was to determine these factors differed by gender.
Methods		
Study design	4	CROSS-SECTIONALSTUDY
Setting	5	The study took place at Inner Mongolia Medical University in Hohhot China, from December 2010 to January 2011
Participants	6	Students grade 1 to 3 in Inner Mongolia Medical University (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Students who used to reside in cities or suburbs were classified as urban, while those previously residing in villages or pastoral areas were classified rural; only child was defined a person without siblings; We defined breakfast followed our previously research which is any food or beverage consumption between awakening and 45 minutes after the start of school. Subjects who did not consume breakfast on one of two days or neither day were categorized as breakfast skippers, while those that consumed breakfast on both days were classified as breakfast eaters, a sports participant was defined as a person who did sports at least 1 hour per week; staying up was defined as going to bed after midnight; a smoker was defined as a current daily smokers or occasional smoker. Gastrointestinal problems were defined as recurring symptoms that were significant enough to alter lifestyle or require chronic treatment and quality of relationships (poor, medium, good) were self-assessed.
Data sources/ measurement	8*	Grade, gender, Residential, only child, Monthly expenses, smoke, breakfast, relationship, Gastrointestinal problems, sport, stay up, ethic data was measured by self-report questionnaire. According to the National Physical Training Qualification Standards promulgated by the Ministry of Education of the People's Republic of China, students in full-time elementary, junior, senior, and secondary vocational schools, and colleges and universities must take a physical fitness test. The University group test includes 6 items of which height, weight, vital capacity, speed, flexibility and endurance. Speed score was measured by the 100 meters run; flexibility by sit and reach; vital capacity by a vital capacity meter; and endurance by a 800 m run for females and 1 km run for males.
Bias	9	The survey was carried out in the classroom.Investigators distributed questionnaires and asked students to complete the questionnaires in the classroom. Investigators were present to answer any questions regarding the questionnaire. Participants returned the completed questionnaire to investigators some of whom checked the questionnaire while others counted the number of questionnaires.

		Physical fitness test data were obtained from the school's sports department. According to the National Physical Training Qualification Standards carry out test. Before the test, a student needs to get a test card before taking the test in an established room, speed and endurance are conducted outside on a running track. Identity is verified to be consistent with the card to avoid students switching cards.
Study size	10	Nearly 6000 students in school, we carry out a general investigation.
Quantitative variables	11	t test, logistic regression
Statistical methods	12	(*a*) BMI compute by weight(kg)/height (m) ^{2} and prevalence of being overweight by gender the mean study BMI was compared with national Chinese figures using a t test. The prevalence of being overweight was then calculated using the previously enumerated lifestyle factors. Next, crude odds ratios (OR) were calculated to evaluate the risk of exposure effects in the group under study relative to the reference group and associated 95% confidence intervals (CI). A non-conditional binary logistic regression analysis was used to ascertain factors associated with being overweight. This method was used for analyses with dependent variables in two categories (in this case, overweight and normal weight). Independent variables included the enumerated lifestyle and other factors. Adjusted OR used logistic regression models to explore the relationship between the independent variables on the dependent variable in model. In the models an OR >1.0 designated increased overweight risk and OR <1.0 indicated protective factors. An independent-sample t test was used to compare physical scores in overweight vs. normal weight groups by gender. The trend chi-square test was used to ascertain any dose-dependent relationships between the prevalence of being overweight and physical fitness by gender. A significance level of p = 0.05 was accepted for all analysis.
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) missing data were less than 10%, listwise
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Questionnaire survey: he/she was not in the school at the survey time Physical fitness test: disability or in illness at the test time
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) University students
		(b)grade 0 missing, only child 9 missing, resident 20 missing, stay up 2 missing, smoke 0 missing, relationship 16missing, sport 8 missing, breakfast 4 missing, Gastrointestinal problems 88 missing, monthly expenses 11 missing
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		5
Main results	16	1.The BMI for males was 22.1 ±2.9, and for females 21.2 ±2.2. On average, the males had a higher BMI than did the female. 2. The overall prevalence of being overweight among Inner Mongolia medical students was 7.6% in which over 13% of the students were obese. The prevalence of being overweight among males was significantly higher than among female (13.6% vs. 5.1%). 3. Male students who were prior urban residents were also at higher risk for being overweight. For female medical students, compared with those who had siblings, only children had nearly 1.5 times higher risk of being overweight; staying up late also was also associated with a similar level of risk. participating in sports for females was protective. 4. A reduced physical score was found for all items in males and 3 items (speed, vital capacity, and endurance) in females. 5. Dose-dependency relationship between overweight prevalence and physical fitness score
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	This study shows that being an only child and resident in an urban area are risk factors, staying up late and lack of physical activities increased the risk of being overweight. BMI was associated with declines in physical fitness.
Limitations	19	Lifestyle data were assessed on the basis of self-reported data only, without the use of experimental measurements. In contrast, the response rate and large number of participants are strengths of the study.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	While medical students might have knowledge regarding the consequences of inappropriate body weight, a substantial number ignore this knowledge. School administrators should encourage students to actively participate in body weight training and education to improve attitudes toward inappropriate body weight, to increase protective factors, and reduce the risk factors for inappropriate body weight, especially in only children.

Other information

Funding	22	The research was supported by Natural Science Foundation of Inner Mongolia in China. 2013MS1193 from the Ministry of Science and Technology.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors Associated with being Overweight among Inner Mongolia Medical Students in China

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Factors Associated with being Overweight among Inner Mongolia Medical Students in China

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Abstract

Objectives: a major goal of our study was to identify the associations between lifestyle factors and obesity in adolescents and young adults at risk by surveying students in Inner Mongolia Medical University. A second goal was to determine these factors differed by gender.

Design: Cross-sectional study

Setting: Students grade 1 to 3 in Inner Mongolia Medical University

Participants: 5471 grade 1-3 medical students, composed of 3891 females and 1580 males. Students BMI ≥25 was defined as overweight.

Results: BMI for males was 22.1 ±2.9 and 21.2 ±2.2 for females. The prevalence of overweight was 7.6%, with the prevalence being higher for males compared to females, urban higher than rural, and being an only child higher than having sibling children. For males, urban residence was a risk factor, while for females being an only child and staying up at night were risk factors, with physical activity a protective factor. A dose-dependency relationship was found between physical fitness and overweight prevalence.

Conclusions: This study shows that being an only child and resident in an urban area are risk factors, staying up late and lack of physical activities increased the risk of being overweight. BMI was associated with declines in physical fitness. Our study provides more insight into adolescent obesity problems.

Article Summary

Article Focus

To identify the demographic, socioeconomic, and lifestyle factors associated with overweight in a specific population of medical students.

Key Messages

1. Being an only child is just one of the determinants; location of residence is also important.
2. Students who reside in urban areas and who stay up late have a higher risk of being overweight.
3. Being overweight leads to less physical activities and poor physical fitness, which in turn increases the risk of being overweight.

Strengths and Limitations

Factors in our study were assessed on the basis of self-reported data only, without experimental measurements. In contrast, the response rate and large number of participants are strengths of the study.

Introduction

Globally, obesity has increased among children, adolescents, and adults; at least 2.8 million people die each year worldwide as a result of being overweight or obese, with mortality rates being proportional to degree of obesity [1]. Younger age groups are affected, as demonstrated in the near one-third of American college students who are overweight or obese [2]. According to the World Health Organization, some 30–80% of adults and about 20% of children and adolescents in Europe are overweight [3]. The situation in Asia is better, with lower prevalences of obesity in Thailand [4] and China [5], although China is experiencing a rapid increase in the number of people classified as overweight or obese.

With obesity becoming an overwhelming global public health issue, there are a multitude of obesity-associated diseases, including heart disease, diabetes, hypertension, and certain cancers. Although obesity is less prominently associated with morbidity in adolescence [6], it is nevertheless a strong precursor of obesity and related morbidity in adulthood [7]. Adolescence has been identified as a critical period in the development of overweight/obesity patterns [8], with the transition to college being another potentially important period of risk for weight increase among young adults [9]. In China, obesity is increasing [5], with the prevalence of overweight or obesity among men in 1991 increasing from 9.6% and 0.6%, respectively, to 20.0% and 3.0%, respectively, in 2000; the figures were comparable for women, in whom there was an increase from 14.5% and 1.8%, respectively,

to 26.5% and 5.2%, respectively [10].

Inner Mongolia is a region inhabited by the Mongolian ethnic minority (1 of 5 minority ethnic autonomous regions in China); there is also a large population of Han people in the region [11]. The current study considered the effect of ethnicity on overweight.

A study showed that 1-child families (only child) were a risk factor for obesity [12]. A family-planning policy has been implemented since the 1970s. We considered the effect of 1-child families on overweight.

Based on our previous study [11], the current study focused on demographic, socioeconomic, and lifestyle factors in relation to overweight in medical students in Inner Mongolia. To the best of our knowledge, no studies have analysed factors related to overweight among medical students thus far. As medical students are future health professionals, it is also important to measure their body weight to determine if this is a problem. The health and health habits of health professionals may influence their attitudes toward relevant professional behaviours, which has been demonstrated by studies of weight status in health professionals [10].

Methods

Participants

A cross-sectional survey [13] was conducted among medical students at the Inner Mongolia Medical University of China. The survey employed a self-administered questionnaire (Supplementary File 1).

In terms of ethnicity, there were 3 categories: Han, Mongolian (the minority), and other. The ethnicity information of the participants was obtained from basic information in the university database.

Physical Fitness Test Data

Physical fitness test data were obtained from the sports department of the school and included height, weight, speed, flexibility, vital capacity, and endurance score data. We used height and weight to determine the body mass index (BMI, kg/m^2) based on the National Heart, Lung, and Blood Institute criteria as follows: <18.5, underweight; 18.5–24.9, normal weight; 25-30, overweight; BMI ≥ 30 was considered obese [14]. In our study, BMI ≥25 were consider as overweight. We categorised the students' physical health status according to the college student physical health standard defined by the Ministry of Education of China and General Administration of Sport of China. [15] Flexibility was measured by sit-and-reach, and vital capacity by a vital capacity meter; vital capacity was calculated as follows: Vital capacity index = Vital capacity (mL)/weight index (kg), with <60 as 'poor', 60–69 as 'normal', 70–79 as 'intermediate', 80–89 as 'good', and 90–100 as 'excellent'. Speed score was measured by a 100-meter run; in men, times of >14.9 seconds were awarded a score of <60; 14.2 seconds–14.9 seconds, 60–69; 13.8 second–14.1 seconds, 70–79; 13.2 seconds–13.7 seconds, 80–89; <13.1 second, 90–100, and in women, >17.9 seconds was awarded a score of <60; 17.4 seconds–17.9 seconds, 60–69; 16.8 seconds–17.3 second, 70–79; 16.2 seconds–16.7 seconds, 80–89; <16.2 seconds, 90–100. Endurance was evaluated in women with a 800-m run: times >4 minutes and 24 seconds were awarded a score of <60; 4 minutes and 8 seconds–4 minutes and 23 seconds, 60–69; 3 minutes and 52 seconds–4 minutes and 7 seconds, 70–79; 3 minutes and 39 seconds–3 minutes and 51 seconds, 80–89; <3 minutes and 50 seconds, as 90–100, and a 1-km run for men, with >4 minutes and 33 seconds being awarded a score of <60; 4 minutes and 12 seconds–4 minutes and 32 seconds,

60–69; 3 minutes and 52 seconds–4 minutes and 11 seconds, 70–79;3 minutes and 39 seconds–3 minutes and 51 seconds, 80–89; <3 minutes and 50 seconds, 90–100.

Survey Data

The data were collected from December 2010 to January 2011 from 5471 grade 1–3 medical students; there were 3891 women and 1580 men.

The survey was carried out in the classroom. In cooperation with faculty management, students were informed of the purposes of the study. They were assured of confidentiality and that participation was voluntary.

Investigators distributed questionnaires and asked students to complete the questionnaires in the classroom. Participants returned the completed questionnaire to the investigators, some of whom checked the questionnaire while others counted the number of questionnaires. Finally, the investigators placed the questionnaires in a sealed envelope [13].

The self-report questionnaire contained questions about basic information, including student ID, sex, ethnicity, living habits, and feelings experienced while in college [11, 13, 16]. In the questionnaire, the following definitions were used: students who used to reside in cities or the suburbs were urban; those previously residing in villages or pastoral areas were rural; 'only child' was defined a person without siblings. Breakfast was defined according to Alexander: 'Subjects who did not consume breakfast on both days were categorised as breakfast skippers. Subjects who consumed breakfast on one of the two days were categorised as occasional breakfast eaters, while those that consumed breakfast on both days were classified as breakfast eaters' [17]. Based on Olds TS's study about "Activity Patterns" which was recommended by Australian government, 'sports participant' was defined as a

person who participated in moderate to vigorous physical activity at least 1 hour/day over 4 days/week [18]. We referred to Giannotti F's research on 'Evening-types': significantly later bedtimes on weekdays and weekends [19], to defined 'staying up' as going to bed after midnight over 2 days/week; 'smoker' was defined as current daily smoking or occasional smoking according to Bian et al. [13] which was initially based on the National Centre for Health Statistics [20]. 'Gastrointestinal problems' were defined as recurring symptoms of sufficient significance to alter lifestyle or require chronic treatment according to Stone JM's report [21], and 'quality of relationships' (poor, medium, good) was self-assessed.

Statistical Analysis

A χ^2 test was used to examine the differences of prevalence of overweight by sex according to demographic, socioeconomic, and lifestyle factors. Crude odds ratios (OR) were calculated to evaluate the risk of exposure effects in the group studied relative to the reference group and associated 95% confidence intervals (CI). Non-conditional binary logistic regression analysis was used to ascertain factors associated with being overweight. This method was used for analyses with dependent variables in 2 categories (overweight and normal weight). Adjusted OR used logistic regression models to explore the effect of the independent variables on the dependent variable in the model. In the models, OR > 1.0 indicated increased overweight risk and OR < 1.0 indicated protective factors. An independent-sample *t*-test was used to compare physical scores in overweight vs. normal weight groups by sex. The trend χ^2 test was used to ascertain any dose-dependent relationships between the prevalence of overweight and physical fitness according to sex.

A significance level of P = 0.05 was accepted for all analyses. Quantitative data were inputted using EpiData v3.1 and analysed using SPSS v.13.0.

Results

Sample Characteristics

Of 5673 grade 1–3 students registered in the school, 5471 (96.44%) completed our survey. Of 5471 students, 414 were overweight. The overall prevalence of overweight was 7.6%. Because our research focused on overweight 356 underweight students were not analysed. There were 1580 men and 3891 women. The mean age of the participants was 21.0 ± 1.4 years.

BMI and Prevalence of Overweight or Obese

The BMI for men was 22.1 ± 2.9; that for women was 21.2 ± 2.2. On average, the men had higher BMI than the women did.

Overweight-Related Factors

The prevalence of overweight among men was significantly higher than that among women (13.6% vs. 5.1%). The prevalence of overweight in male students who were prior urban residents was nearly twice that of prior rural residents, and in only children (Table 1). In women, the prevalence of overweight in only children was nearly twice that of those who were not, and nearly 50% higher in prior urban residents compared to prior rural residents. In prior urban residents, the prevalence of overweight for only children was 12.5% vs. 7.8% of those with siblings. In prior rural residents, the pattern was similar but overall prevalence was lower: 8.8% vs. 5.8%. In male students, prevalence of overweight was substantially higher as

compared to female students when comparing urban vs. rural, and then only children vs. children with siblings: 21.2% vs. 15.8% and 11.5% vs. 10.6% (men), 8.4% vs. 5.2% and 5.8% vs. 4.3% (women), respectively. Prevalence of overweight was 50% higher in students who skipped breakfast compared to their breakfast-eating counterparts. Similarly, prevalence of overweight in students who were smokers or stayed up late was nearly double compared to those who did not.

Factors Associated with Being Overweight

Students who were prior urban residents were at higher risk for being overweight. Although male students who were only children or stayed up late were at higher risk for being overweight in univariate analysis, there was no difference in multivariate analysis. There was no difference in overweight between Mongolian and Han ethnicities (Table 2).

In female students, only children had nearly 1.5 times higher risk of being overweight compared with those who had siblings; staying up late was associated with a similar level of risk. However, unlike men, participating in sports was protective for women. While univariate analysis revealed a significantly higher risk of being overweight with higher monthly expenses, this risk became non-significant in multivariate analysis. Quality of relationships had no impact on being overweight.

Physical Fitness in Overweight and Normal-weight Students

The physical scores of normal-weight and overweight students were compared for male and female students, respectively (Table 3). A reduced physical score was found for all items in men and 3 items (speed, vital capacity, and endurance) in women. The highest reduction between normal-weight and overweight subjects was for vital capacity.

Dose-Dependent Relationship between Overweight Prevalence and Physical Fitness Score

Analysing the associations between physical fitness score and the prevalence of overweight, we found that as physical fitness score increased, the prevalence of overweight decreased in the categories of speed, vital capacity, and endurance (Table 4). This suggested a dose-dependent relationship between physical fitness and the prevalence of overweight. However, we did not find this trend with regard to flexibility for both sexes.

Discussion

While many studies have reported that demographic, socioeconomic, and lifestyle factors are associated with adolescent obesity, the results are not always consistent; therefore, we carried out a survey to investigate whether these factors constituted a risk for being overweight in medical students.

The prevalence of overweight was 7.6%. This is considerably lower compared to the reported prevalence among the general Chinese population [22]. The prevalence of overweight in the current study was also lower compared with other reports of college students in the USA [23] and in European countries such as Greece [24]. Consistent with other research [2, 4], the male students in our study had significantly higher mean BMI than the female students did, although the values were considerably lower compared with American college students [2], but higher than that in Thai college students [4]. Our results suggest that overweight was significantly more prevalent in male students than in female students. This finding is consistent with recently reported data [2, 11]. The higher prevalence of overweight and obesity among men may be partially due to the fact that male students are usually satisfied with their weight and body image, in addition to bulking up and increasing

muscle/weight [2]. Thus, female college students are more likely to perceive themselves as overweight and attempt to lose weight more often [25]. These factors may explain the sex discrepancy in BMI prevalence.

The demographic factor of being an only child in relation to overweight has been studied [26]. In our study, only children were distinguished from that in other countries as China is one of the few countries to enforce a family planning policy, and since the advent of the family planning policy in the 1970s, children without siblings—only children—have become more numerous as a group. The prevalence of overweight in only children is higher because the only child always lives in more favourable conditions. Our study showed that about 60% of all only children had monthly expenses > 600 Yuan, while <30% of students with siblings spent the same amount monthly.

Our results also provide some support for the type of residency being important in relation to being overweight. Numerous studies have reported that adolescents residing in urban areas have a higher risk of being overweight. For example, this is the case in Thailand [27]. Conversely, the authors of a Canadian study reported that there was a trend for increasing overweight or obesity among adolescents as the degree of living in a rural area improved [28]. Over the past 3 decades, China has enjoyed economic development and the population has experienced lifestyle changes. Reductions in physical activity and labour intensity in both urban and rural areas have been observed, and in 2010, the prevalence of overweight or obesity in men was higher than in women and in urban residents compared to rural residents [29]. This result appears to originate from cultural attitudes and beliefs. For urban students, the perception is that the pursuit of academic excellence holds greater status

than physical activity. Typically, parents encourage their children to engage in educational and spiritual activities rather than physical activities, but rural students are additionally expected to participate in some physically demanding farming activities [30].

Besides demographic factors, we also investigated lifestyle factors. Students who stay up late face an increased risk of being overweight. Noland et al. reported that students with fewer hours of sleep were significantly more likely to be overweight [31]; other researchers have found that shorter sleep periods are associated with decreased leptin levels, increased ghrelin levels, and increased hunger and appetite [32, 33].

Although lack of physical activity increases the risk of obesity, being overweight also is associated with poor physical fitness. We found that overweight adolescents generally had poorer physical fitness than their normal-weight counterparts did. This result is in agreement with our previous medical student study [11]. In the present study, overweight students had lower speed, endurance, and vital capacity, a finding similar to that of another investigation [34]. There was no difference in flexibility between overweight and normal-weight students. This is in line with a Taiwanese study [35] but contrasts a Western report in which overweight girls achieved slightly better sit-and-reach results than normal-weight girls did [36]. Flexibility, therefore, appears to be consistently less influenced by body weight. There was a dose-dependent relationship in our study, with physical fitness score increasing as prevalence of overweight declined. The authors of another Chinese study reported that obese children are less mobile and less self-confident, which makes them participate in less physical activities, leaving them at risk for chronic disease [34]. Again, this suggests a vicious cycle: being

overweight leads to less physical activities and poor physical fitness, in turn increasing the risk of being overweight.

Socioeconomic factors were not related with overweight. However, it is worth mentioning that good relationships may stimulate participation in more sports activities, which could reduce the risk of obesity [37].

In our study of lifestyle factors, skipping breakfast and being a smoker did not affect overweight. The result was similar to that of 2 previous reports [38, 39].

Although the association of the factors above with being overweight are well known, and medical students are future health professionals, some have the persistent habits of staying up late and engaging in less physical activities. They do not have deep understanding of the significance of the potential danger of these habits. This could be a reflection of the attitude of our college students regarding these well-known factors. Changing their attitude is the key to reducing the risk factors for inappropriate body weight.

There are limitations to this study. Overweight-related factors were assessed on the basis of self-reported data only, without experimental measurements. The response rate and large number of participants are strengths of the study.

Table 1. Prevalence of overweight by sex.

Characteristic	Total		Men		Women			
	n	%	n	%	n	%	χ^2	P
Demographic								
Ethnic	5471		1580		3891		4.68	0.096
Han	3943	7.6	1145	14.4	2798	4.8		
Mongolian	1275	7.4	349	11.5	926	5.8		
Other	253	8.7	86	11.6	167	7.2		
Resident	5451		1573		3878		0.08	0.782
Urban	2209	9.9	642	18.2	1567	6.5		
Rural	3242	5.9	931	10.3	2311	4.1		
Only child	5462						114	<0.000
Yes	1866	10.7	708	16.4	1158	7.2		
No	3596	6.0	868	11.4	2728	4.2		
Socioeconomic								
Grade	5471		1580		3891		42.03	<0.000
1	2362	7.1	577	11.8	1785	5.5		
2	1879	7.7	589	13.6	1290	5.0		
3	1230	8.4	414	16.2	816	4.4		
Monthly expenses (Yuan)	5457						120.9	<0.000
<300	436	4.8	64	10.9	372	3.8		
300–600	2877	5.9	732	10.0	2145	4.5		
600–1000	1878	9.9	674	16.9	1204	6.0		
>1000	266	13.5	107	19.6	159	9.4		
Relationship	5452						35.48	<0.000
Poor	124	7.3	41	2.4	83	9.6		
Medium	3135	7.2	806	13.5	2329	5.0		

Good	2193	8.1	726	14.3	1467	5.0		
Lifestyle								
Skip breakfast	5466						162.1	<0.000
No	3906	6.6	935	12.2	2971	4.8		
Yes	1560	10.0	643	15.7	917	6.0		
Gastrointestinal discomfort	5373						3.33	0.068
No	4658	7.8	1353	14.2	3305	5.2		
Yes	715	6.2	184	11.4	531	4.3		
Sports	5462						195	<0.000
No	2568	6.7	508	15.2	2060	4.6		
Yes	2894	8.4	1069	12.9	1825	5.7		
Smoke	5471						935	<0.000
No	4976	7.2	1143	14.3	3833	5.1		
Yes	495	11.5	437	11.9	58	8.6		
Stay up	5465						107.5	<0.000
No	4370	6.8	1122	12.7	3248	4.8		
Yes	1095	10.5	455	15.8	640	6.7		
Stress	5471						28.96	<0.000
No	95	9.5	51	15.7	44	2.3		
Yes	5376	7.5	1529	13.5	3847	5.1		

Table 2. Univariate (crude OR) and multivariate (adjusted OR) logistic regression analysis of being overweight by sex.

	Men					Women				
		Crude		Adjust			Crude		Adjust	
Factor	n	OR	95% CI	OR	95% CI	n	OR	95% CI	OR	95% CI
Demographic										
Ethnic	215					199				
Han	165	1.000		1.000		133	1.000			
Mongolian	40	0.774	0.535-1.121	0.792	0.533-1.176	54	1.227	0.886-1.700	1.224	0.847-1.713
Other	10	0.777	0.393-1.536	0.661	0.318-1.374	12	1.563	0.845-2.890	1.554	0.831-2.904
Resident										
Urban	117	1.000				102	1.000		1.000	
Rural	96	1.956	1.460-2.620	1.634	1.171-2.279	95	1.639	1.229-2.186	1.241	0.866-1.799
Only child										
Yes	99	1.000		1.000		115	1.000		1.000	
No	116	1.540	1.153-2.059	1.111	0.798-1.548	83	1.792	1.338-2.399	1.488	1.047-2.114
Socioeconomic Grade										
1	68	1.000		1.000		99	1.000		1.000	
2	80	1.157	0.818-1.637	1.094	0.752-1.590	64	0.894	0.647-1.236	0.830	0.594-1.161
3	67	1.472	1.021-2.122	1.479	1.000-2.187	36	0.818	0.553-1.210	0.810	0.540-1.213
Monthly expenses (Yuan)										
<300	7	1.000		1.000		14	1.000		1.000	
300–600	73	0.914	0.401-2.084	0.773	0.332-1.796	97	1.257	0.709-2.227	1.239	0.680-2.256
600–1000	114	1.656	0.735-3.734	1.168	0.504-2.706	72	1.685	0.938-3.025	1.414	0.745-2.681
>1000	21	2.000	0.795-5.029	1.333	0.509-3.487	15	2.894	1.358-6.164	2.068	0.907-4.715
Relationship										
Poor	1	1.000		1.000		8	1.000		1.000	

Medium	109	6.205	0.843-45.691	5.780	0.775-43.107	116	0.485	0.228-1.033	0.415	0.192-0.896
Good	104	6.511	0.884-47.975	6.163	0.825-46.052	74	0.482	0.223-1.039	0.363	0.165-0.801
Lifestyle										
Skip breakfast										
No	114	1.000		1.000		143	1.000		1.000	
Yes	101	0.746	0.558-0.997	0.885	0.640-1.225	55	0.775	0.562-1.068	0.806	0.571-1.140
Gastrointestinal discomfort										
No	192	1.000		1.000		173	1.000		1.000	
Yes	21	0.809	0.500-1.310	0.793	0.484-1.301	23	0.824	0.528-1.288	0.821	0.523-1.289
Sports										
No	77	1.000		1.000		94	1.000		1.000	
Yes	138	0.796	0.588-1.078	0.872	0.627-1.214	104	0.828	0.722-0.936	0.934	0.843-0.985
Smoke										
No	163	1.000		1.000		194	1.000		1.000	
Yes	52	0.797	0.570-1.114	0.782	0.551-1.109	5	1.847	0.727-4.698	1.632	0.632-4.212
Stay up										
No	143	1.000		1.000		156	1.000		1.000	
Yes	72	1.391	1.021-1.895	1.253	0.901-1.742	43	1.740	1.244-2.473	1.481	1.021-2.150

OR, odds ratio; CI, confidence interval.

Table 3. Comparison of physical score between normal weight and overweight by sex.

Sex	Item	Normal weight	Overweight	P
	Speed	64.8 ± 0.6	50.9 ± 1.8	0.000
Men	Vital capacity	66.5 ± 0.5	37.1 ± 1.7	0.000
(mean ± SE)	Endurance	70.5 ± 0.6	59.3 ± 1.6	0.000
	Flexibility	86.2 ± 0.3	83.7 ± 0.9	0.007
	Speed	62.0 ± 0.3	54.9 ± 1.6	0.000
Women	Vital capacity	64.7 ± 0.3	46.1 ± 1.6	0.000
(mean ± SE)	Endurance	73.3 ± 0.3	67.8 ± 1.2	0.039
	Flexibility	92.9 ± 0.2	93.0 ± 0.7	0.951

SE, standard error.

Table 4. Trend χ^2 test between physical fitness score and overweight prevalence by sex.

Sex	Item	Score (Prevalence, %)					P
		<60	60–69	70–79	80–89	90–100	
Men	Vital capacity	323 (40.2)	563 (10.5)	307 (2.3)	142 (1.4)	119 (0.8)	0.000
	Endurance	190 (28.5)	480 (17.7)	366 (11.5)	195 (7.7)	223 (3.6)	0.000
	Flexibility	10 (20.0)	149 (20.8)	300 (13.7)	344 (11.6)	651(13.1)	0.051
	Speed	284 (27.5)	656 (13.6)	243 (7.4)	144 (5.6)	127 (4.7)	0.000
Women	Vital capacity	638 (14.6)	1612 (5.0)	721 (1.5)	296 (0.7)	276 (0.7)	0.000
	Endurance	210 (9.5)	1258 (7.1)	867 (4.4)	612 (3.9)	596 (2.9)	0.000
	Flexibility	6 (0.0)	87 (2.3)	291 (6.2)	654 (5.8)	2505 (5.2)	0.944
	Speed	697 (7.6)	1687 (6.1)	783 (2.9)	262 (2.3)	114 (1.6)	0.000

Ethical Approval

Ethical approval to conduct the study, in which consent was required from all study participants, was obtained from the Ethical Committee of Inner Mongolia.

Conflicts of Interest Statement

The authors declare that they have no competing interests.

Sharing Statement

No additional data available.

Author Contributions

JC, ZL, JB, and JS designed the study, acquired and analysed the data, and prepared the manuscript. JS, ZL, WG, and WC assisted in the data analysis and interpretation. YE supervised the study.

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Factors Associated with being Overweight among Inner Mongolia Medical Students in China

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Article Summary

Article Focus

To identify the demographic, socioeconomic, and lifestyle factors associated with overweight in a specific population of medical students.

Key Messages

1. Being an only child is just one of the determinants; location of residence is also important.
2. Students who reside in urban areas and who stay up late have a higher risk of being overweight.
3. Being overweight leads to less physical activities and poor physical fitness, which in turn increases the risk of being overweight.

Strengths and Limitations

Factors in our study were assessed on the basis of self-reported data only, without experimental measurements. In contrast, the response rate and large number of participants are strengths of the study.

Abstract

Objectives: We aimed to identify the demographic, socioeconomic, and lifestyle factors associated with being overweight among Inner Mongolia medical students in China.

Methods: A cross-sectional study was conducted among students at the Inner Mongolia Medical University of China. The survey employed a self-administered questionnaire. The self-report questionnaire contained questions about basic information, including student ID, sex, ethnicity, living habits, and feelings experienced while in college. Students were grade 1–3 and there were 3891 women and 1580 men. Body mass index (BMI) ≥ 25 was defined as overweight.

Results: The BMI for men was 22.1 ± 2.9; that for women was 21.2 ± 2.2. The prevalence of overweight was 7.6%, with prevalence being higher in men, urban residents, and only children than in women, rural residents, and students with siblings, respectively. For men, urban residence was a risk factor for overweight for women, being an only child and staying up late were risk factors, with physical activity being a protective factor. There was a dose-dependent relationship between physical fitness and overweight prevalence.

Conclusions: Being an only child and residing in an urban area are risk factors for being overweight; staying up late and lack of physical activities increased the risk of being overweight. BMI is associated with decline in physical fitness. Our study provides more insight into adolescent obesity problems.

Introduction

Globally, obesity has increased among children, adolescents, and adults; at least 2.8 million people die each year worldwide as a result of being overweight or obese, with mortality rates being proportional to degree of obesity [1]. Younger age groups are affected, as demonstrated in the near one-third of American college students who are overweight or obese [2]. According to the World Health Organization, some 30–80% of adults and about 20% of children and adolescents in Europe are overweight [3]. The situation in Asia is better, with lower prevalences of obesity in Thailand [4] and China [5], although China is experiencing a rapid increase in the number of people classified as overweight or obese.

With obesity becoming an overwhelming global public health issue, there are a multitude of obesity-associated diseases, including heart disease, diabetes, hypertension, and certain cancers. Although obesity is less prominently associated with morbidity in adolescence [6], it is nevertheless a strong precursor of obesity and related morbidity in adulthood [7]. Adolescence has been identified as a critical period in the development of overweight/obesity patterns [8], with the transition to college being another potentially important period of risk for weight increase among young adults [9]. In China, obesity is increasing [5], with the prevalence of overweight or obesity among men in 1991 increasing from 9.6% and 0.6%, respectively, to 20.0% and 3.0%, respectively, in 2000; the figures were comparable for women, in whom there was an increase from 14.5% and 1.8%, respectively, to 26.5% and 5.2%, respectively [10].

Inner Mongolia is a region inhabited by the Mongolian ethnic minority (1 of 5 minority ethnic autonomous regions in China); there is also a large population of Han people in the

region [11]. The current study considered the effect of ethnicity on overweight.

A study showed that 1-child families (only child) were a risk factor for obesity [12]. A family-planning policy has been implemented since the 1970s. We considered the effect of 1-child families on overweight.

Based on our previous study [11], the current study focused on demographic, socioeconomic, and lifestyle factors in relation to overweight in medical students in Inner Mongolia. To the best of our knowledge, no studies have analysed factors related to overweight among medical students thus far. As medical students are future health professionals, it is also important to measure their body weight to determine if this is a problem. The health and health habits of health professionals may influence their attitudes toward relevant professional behaviours, which has been demonstrated by studies of weight status in health professionals [10].

Methods

Participants

A cross-sectional survey [13] was conducted among medical students at the Inner Mongolia Medical University of China. The survey employed a self-administered questionnaire (Supplementary File 1).

In terms of ethnicity, there were 3 categories: Han, Mongolian (the minority), and other. The ethnicity information of the participants was obtained from basic information in the university database.

Physical Fitness Test Data

Physical fitness test data were obtained from the sports department of the school and included height, weight, speed, flexibility, vital capacity, and endurance score data. We used

height and weight to determine the body mass index (BMI, kg/m^2) based on the National Heart, Lung, and Blood Institute criteria as follows: <18.5, underweight; 18.5–24.9, normal weight; 25-30, overweight; BMI ≥ 30 was considered obese [14]. In our study, BMI ≥25 were consider as overweight. We categorised the students' physical health status according to the college student physical health standard defined by the Ministry of Education of China and General Administration of Sport of China. [15] Flexibility was measured by sit-and-reach, and vital capacity by a vital capacity meter; vital capacity was calculated as follows: Vital capacity index = Vital capacity (mL)/weight index (kg), with <60 as 'poor', 60–69 as 'normal', 70–79 as 'intermediate', 80–89 as 'good', and 90–100 as 'excellent'. Speed score was measured by a 100-meter run; in men, times of >14.9 seconds were awarded a score of <60; 14.2 seconds–14.9 seconds, 60–69; 13.8 second–14.1 seconds, 70–79; 13.2 seconds–13.7 seconds, 80–89; <13.1 second, 90–100, and in women, >17.9 seconds was awarded a score of <60; 17.4 seconds–17.9 seconds, 60–69; 16.8 seconds–17.3 second, 70–79; 16.2 seconds–16.7 seconds, 80–89; <16.2 seconds, 90–100. Endurance was evaluated in women with a 800-m run: times >4 minutes and 24 seconds were awarded a score of <60; 4 minutes and 8 seconds–4 minutes and 23 seconds, 60–69; 3 minutes and 52 seconds–4 minutes and 7 seconds, 70–79; 3 minutes and 39 seconds–3 minutes and 51 seconds, 80–89; <3 minutes and 50 seconds, as 90–100, and a 1-km run for men, with >4 minutes and 33 seconds being awarded a score of <60; 4 minutes and 12 seconds–4 minutes and 32 seconds, 60–69; 3 minutes and 52 seconds–4 minutes and 11 seconds, 70–79;3 minutes and 39 seconds–3 minutes and 51 seconds, 80–89; <3 minutes and 50 seconds, 90–100.

Survey Data

The data were collected from December 2010 to January 2011 from 5471 grade 1–3 medical students; there were 3891 women and 1580 men.

The survey was carried out in the classroom. In cooperation with faculty management, students were informed of the purposes of the study. They were assured of confidentiality and that participation was voluntary.

Investigators distributed questionnaires and asked students to complete the questionnaires in the classroom. Participants returned the completed questionnaire to the investigators, some of whom checked the questionnaire while others counted the number of questionnaires. Finally, the investigators placed the questionnaires in a sealed envelope [13].

The self-report questionnaire contained questions about basic information, including student ID, sex, ethnicity, living habits, and feelings experienced while in college [11, 13, 16]. In the questionnaire, the following definitions were used: students who used to reside in cities or the suburbs were urban; those previously residing in villages or pastoral areas were rural; 'only child' was defined a person without siblings. Breakfast was defined according to Alexander: 'Subjects who did not consume breakfast on both days were categorised as breakfast skippers. Subjects who consumed breakfast on one of the two days were categorised as occasional breakfast eaters, while those that consumed breakfast on both days were classified as breakfast eaters' [17]. Based on Olds TS's study about "Activity Patterns" which was recommended by Australian government, 'sports participant' was defined as a person who participated in moderate to vigorous physical activity at least 1 hour/day over 4 days/week [18]. We referred to Giannotti F's research on 'Evening-types': significantly later bedtimes on weekdays and weekends [19], to defined 'staying up' as going to bed after

midnight over 2 days/week; 'smoker' was defined as current daily smoking or occasional smoking according to Bian et al. [13] which was initially based on the National Centre for Health Statistics [20]. 'Gastrointestinal problems' were defined as recurring symptoms of sufficient significance to alter lifestyle or require chronic treatment according to Stone JM's report [21], and 'quality of relationships' (poor, medium, good) was self-assessed.

Statistical Analysis

A χ^2 test was used to examine the differences of prevalence of overweight by sex according to demographic, socioeconomic, and lifestyle factors. Crude odds ratios (OR) were calculated to evaluate the risk of exposure effects in the group studied relative to the reference group and associated 95% confidence intervals (CI). Non-conditional binary logistic regression analysis was used to ascertain factors associated with being overweight. This method was used for analyses with dependent variables in 2 categories (overweight and normal weight). Adjusted OR used logistic regression models to explore the effect of the independent variables on the dependent variable in the model. In the models, OR > 1.0 indicated increased overweight risk and OR < 1.0 indicated protective factors. An independent-sample *t*-test was used to compare physical scores in overweight vs. normal weight groups by sex. The trend χ^2 test was used to ascertain any dose-dependent relationships between the prevalence of overweight and physical fitness according to sex.

A significance level of P = 0.05 was accepted for all analyses. Quantitative data were inputted using EpiData v3.1 and analysed using SPSS v.13.0.

Results

Sample Characteristics

Of 5673 grade 1–3 students registered in the school, 5471 (96.44%) completed our survey. Of 5471 students, 414 were overweight. The overall prevalence of overweight was 7.6%. Because our research focused on overweight 356 underweight students were not analysed. There were 1580 men and 3891 women. The mean age of the participants was 21.0 ± 1.4 years.

BMI and Prevalence of Overweight or Obese

The BMI for men was 22.1 ± 2.9; that for women was 21.2 ± 2.2. On average, the men had higher BMI than the women did.

Overweight-Related Factors

The prevalence of overweight among men was significantly higher than that among women (13.6% vs. 5.1%). The prevalence of overweight in male students who were prior urban residents was nearly twice that of prior rural residents, and in only children (Table 1). In women, the prevalence of overweight in only children was nearly twice that of those who were not, and nearly 50% higher in prior urban residents compared to prior rural residents. In prior urban residents, the prevalence of overweight for only children was 12.5% vs. 7.8% of those with siblings. In prior rural residents, the pattern was similar but overall prevalence was lower: 8.8% vs. 5.8%. In male students, prevalence of overweight was substantially higher as compared to female students when comparing urban vs. rural, and then only children vs. children with siblings: 21.2% vs. 15.8% and 11.5% vs. 10.6% (men), 8.4% vs. 5.2% and 5.8% vs. 4.3% (women), respectively. Prevalence of overweight was 50% higher in students

who skipped breakfast compared to their breakfast-eating counterparts. Similarly, prevalence of overweight in students who were smokers or stayed up late was nearly double compared to those who did not.

Factors Associated with Being Overweight

Students who were prior urban residents were at higher risk for being overweight. Although male students who were only children or stayed up late were at higher risk for being overweight in univariate analysis, there was no difference in multivariate analysis. There was no difference in overweight between Mongolian and Han ethnicities (Table 2).

In female students, only children had nearly 1.5 times higher risk of being overweight compared with those who had siblings; staying up late was associated with a similar level of risk. However, unlike men, participating in sports was protective for women. While univariate analysis revealed a significantly higher risk of being overweight with higher monthly expenses, this risk became non-significant in multivariate analysis. Quality of relationships had no impact on being overweight.

Physical Fitness in Overweight and Normal-weight Students

The physical scores of normal-weight and overweight students were compared for male and female students, respectively (Table 3). A reduced physical score was found for all items in men and 3 items (speed, vital capacity, and endurance) in women. The highest reduction between normal-weight and overweight subjects was for vital capacity.

Dose-Dependent Relationship between Overweight Prevalence and Physical Fitness Score

Analysing the associations between physical fitness score and the prevalence of overweight, we found that as physical fitness score increased, the prevalence of overweight

decreased in the categories of speed, vital capacity, and endurance (Table 4). This suggested a dose-dependent relationship between physical fitness and the prevalence of overweight. However, we did not find this trend with regard to flexibility for both sexes.

Discussion

While many studies have reported that demographic, socioeconomic, and lifestyle factors are associated with adolescent obesity, the results are not always consistent; therefore, we carried out a survey to investigate whether these factors constituted a risk for being overweight in medical students.

The prevalence of overweight was 7.6%. This is considerably lower compared to the reported prevalence among the general Chinese population [22]. The prevalence of overweight in the current study was also lower compared with other reports of college students in the USA [23] and in European countries such as Greece [24]. Consistent with other research [2, 4], the male students in our study had significantly higher mean BMI than the female students did, although the values were considerably lower compared with American college students [2], but higher than that in Thai college students [4]. Our results suggest that overweight was significantly more prevalent in male students than in female students. This finding is consistent with recently reported data [2, 11]. The higher prevalence of overweight and obesity among men may be partially due to the fact that male students are usually satisfied with their weight and body image, in addition to bulking up and increasing muscle/weight [2]. Thus, female college students are more likely to perceive themselves as overweight and attempt to lose weight more often [25]. These factors may explain the sex discrepancy in BMI prevalence.

The demographic factor of being an only child in relation to overweight has been studied [26]. In our study, only children were distinguished from that in other countries as China is one of the few countries to enforce a family planning policy, and since the advent of the family planning policy in the 1970s, children without siblings—only children—have become more numerous as a group. The prevalence of overweight in only children is higher because the only child always lives in more favourable conditions. Our study showed that about 60% of all only children had monthly expenses > 600 Yuan, while <30% of students with siblings spent the same amount monthly.

Our results also provide some support for the type of residency being important in relation to being overweight. Numerous studies have reported that adolescents residing in urban areas have a higher risk of being overweight. For example, this is the case in Thailand [27]. Conversely, the authors of a Canadian study reported that there was a trend for increasing overweight or obesity among adolescents as the degree of living in a rural area improved [28]. Over the past 3 decades, China has enjoyed economic development and the population has experienced lifestyle changes. Reductions in physical activity and labour intensity in both urban and rural areas have been observed, and in 2010, the prevalence of overweight or obesity in men was higher than in women and in urban residents compared to rural residents [29]. This result appears to originate from cultural attitudes and beliefs. For urban students, the perception is that the pursuit of academic excellence holds greater status than physical activity. Typically, parents encourage their children to engage in educational and spiritual activities rather than physical activities, but rural students are additionally expected to participate in some physically demanding farming activities [30].

Besides demographic factors, we also investigated lifestyle factors. Students who stay up late face an increased risk of being overweight. Noland et al. reported that students with fewer hours of sleep were significantly more likely to be overweight [31]; other researchers have found that shorter sleep periods are associated with decreased leptin levels, increased ghrelin levels, and increased hunger and appetite [32, 33].

Although lack of physical activity increases the risk of obesity, being overweight also is associated with poor physical fitness. We found that overweight adolescents generally had poorer physical fitness than their normal-weight counterparts did. This result is in agreement with our previous medical student study [11]. In the present study, overweight students had lower speed, endurance, and vital capacity, a finding similar to that of another investigation [34]. There was no difference in flexibility between overweight and normal-weight students. This is in line with a Taiwanese study [35] but contrasts a Western report in which overweight girls achieved slightly better sit-and-reach results than normal-weight girls did [36]. Flexibility, therefore, appears to be consistently less influenced by body weight. There was a dose-dependent relationship in our study, with physical fitness score increasing as prevalence of overweight declined. The authors of another Chinese study reported that obese children are less mobile and less self-confident, which makes them participate in less physical activities, leaving them at risk for chronic disease [34]. Again, this suggests a vicious cycle: being overweight leads to less physical activities and poor physical fitness, in turn increasing the risk of being overweight.

Socioeconomic factors were not related with overweight. However, it is worth mentioning that good relationships may stimulate participation in more sports activities, which could reduce the risk of obesity [37].

In our study of lifestyle factors, skipping breakfast and being a smoker did not affect overweight. The result was similar to that of 2 previous reports [38, 39].

Although the association of the factors above with being overweight are well known, and medical students are future health professionals, some have the persistent habits of staying up late and engaging in less physical activities. They do not have deep understanding of the significance of the potential danger of these habits. This could be a reflection of the attitude of our college students regarding these well-known factors. Changing their attitude is the key to reducing the risk factors for inappropriate body weight.

There are limitations to this study. Overweight-related factors were assessed on the basis of self-reported data only, without experimental measurements. The response rate and large number of participants are strengths of the study.

Table 1. Prevalence of overweight by sex.

Characteristic	Total		Men		Women			
	n	%	n	%	n	%	χ^2	P
Demographic								
Ethnic	5471		1580		3891		4.68	0.096
Han	3943	7.6	1145	14.4	2798	4.8		
Mongolian	1275	7.4	349	11.5	926	5.8		
Other	253	8.7	86	11.6	167	7.2		
Resident	5451		1573		3878		0.08	0.782
Urban	2209	9.9	642	18.2	1567	6.5		
Rural	3242	5.9	931	10.3	2311	4.1		
Only child	5462						114	<0.000
Yes	1866	10.7	708	16.4	1158	7.2		
No	3596	6.0	868	11.4	2728	4.2		
Socioeconomic								
Grade	5471		1580		3891		42.03	<0.000
1	2362	7.1	577	11.8	1785	5.5		
2	1879	7.7	589	13.6	1290	5.0		
3	1230	8.4	414	16.2	816	4.4		
Monthly expenses (Yuan)	5457						120.9	<0.000
<300	436	4.8	64	10.9	372	3.8		
300–600	2877	5.9	732	10.0	2145	4.5		
600–1000	1878	9.9	674	16.9	1204	6.0		
>1000	266	13.5	107	19.6	159	9.4		
Relationship	5452						35.48	<0.000
Poor	124	7.3	41	2.4	83	9.6		
Medium	3135	7.2	806	13.5	2329	5.0		

Good	2193	8.1	726	14.3	1467	5.0		
Lifestyle								
Skip breakfast	5466						162.1	<0.000
No	3906	6.6	935	12.2	2971	4.8		
Yes	1560	10.0	643	15.7	917	6.0		
Gastrointestinal discomfort	5373						3.33	0.068
No	4658	7.8	1353	14.2	3305	5.2		
Yes	715	6.2	184	11.4	531	4.3		
Sports	5462						195	<0.000
No	2568	6.7	508	15.2	2060	4.6		
Yes	2894	8.4	1069	12.9	1825	5.7		
Smoke	5471						935	<0.000
No	4976	7.2	1143	14.3	3833	5.1		
Yes	495	11.5	437	11.9	58	8.6		
Stay up	5465						107.5	<0.000
No	4370	6.8	1122	12.7	3248	4.8		
Yes	1095	10.5	455	15.8	640	6.7		
Stress	5471						28.96	<0.000
No	95	9.5	51	15.7	44	2.3		
Yes	5376	7.5	1529	13.5	3847	5.1		

Table 2. Univariate (crude OR) and multivariate (adjusted OR) logistic regression analysis of being overweight by sex.

	Men					Women				
		Crude		Adjust			Crude		Adjust	
Factor	n	OR	95% CI	OR	95% CI	n	OR	95% CI	OR	95% CI
Demographic										
Ethnic	215					199				
Han	165	1.000		1.000		133	1.000			
Mongolian	40	0.774	0.535-1.121	0.792	0.533-1.176	54	1.227	0.886-1.700	1.224	0.847-1.713
Other	10	0.777	0.393-1.536	0.661	0.318-1.374	12	1.563	0.845-2.890	1.554	0.831-2.904
Resident										
Urban	117	1.000				102	1.000		1.000	
Rural	96	1.956	1.460-2.620	1.634	1.171-2.279	95	1.639	1.229-2.186	1.241	0.866-1.799
Only child										
Yes	99	1.000		1.000		115	1.000		1.000	
No	116	1.540	1.153-2.059	1.111	0.798-1.548	83	1.792	1.338-2.399	1.488	1.047-2.114
Socioeconomic Grade										
1	68	1.000		1.000		99	1.000		1.000	
2	80	1.157	0.818-1.637	1.094	0.752-1.590	64	0.894	0.647-1.236	0.830	0.594-1.161
3	67	1.472	1.021-2.122	1.479	1.000-2.187	36	0.818	0.553-1.210	0.810	0.540-1.213
Monthly expenses (Yuan)										
<300	7	1.000		1.000		14	1.000		1.000	
300–600	73	0.914	0.401-2.084	0.773	0.332-1.796	97	1.257	0.709-2.227	1.239	0.680-2.256
600–1000	114	1.656	0.735-3.734	1.168	0.504-2.706	72	1.685	0.938-3.025	1.414	0.745-2.681
>1000	21	2.000	0.795-5.029	1.333	0.509-3.487	15	2.894	1.358-6.164	2.068	0.907-4.715
Relationship										
Poor	1	1.000		1.000		8	1.000		1.000	

Medium	109	6.205	0.843-45.691	5.780	0.775-43.107	116	0.485	0.228-1.033	0.415	0.192-0.896
Good	104	6.511	0.884-47.975	6.163	0.825-46.052	74	0.482	0.223-1.039	0.363	0.165-0.801
Lifestyle										
Skip breakfast										
No	114	1.000		1.000		143	1.000		1.000	
Yes	101	0.746	0.558-0.997	0.885	0.640-1.225	55	0.775	0.562-1.068	0.806	0.571-1.140
Gastrointestinal discomfort										
No	192	1.000		1.000		173	1.000		1.000	
Yes	21	0.809	0.500-1.310	0.793	0.484-1.301	23	0.824	0.528-1.288	0.821	0.523-1.289
Sports										
No	77	1.000		1.000		94	1.000		1.000	
Yes	138	0.796	0.588-1.078	0.872	0.627-1.214	104	0.828	0.722-0.936	0.934	0.843-0.985
Smoke										
No	163	1.000		1.000		194	1.000		1.000	
Yes	52	0.797	0.570-1.114	0.782	0.551-1.109	5	1.847	0.727-4.698	1.632	0.632-4.212
Stay up										
No	143	1.000		1.000		156	1.000		1.000	
Yes	72	1.391	1.021-1.895	1.253	0.901-1.742	43	1.740	1.244-2.473	1.481	1.021-2.150

OR, odds ratio; CI, confidence interval.

Table 3. Comparison of physical score between normal weight and overweight by sex.

Sex	Item	Normal weight	Overweight	P
	Speed	64.8 ± 0.6	50.9 ± 1.8	0.000
Men	Vital capacity	66.5 ± 0.5	37.1 ± 1.7	0.000
(mean ± SE)	Endurance	70.5 ± 0.6	59.3 ± 1.6	0.000
	Flexibility	86.2 ± 0.3	83.7 ± 0.9	0.007
	Speed	62.0 ± 0.3	54.9 ± 1.6	0.000
Women	Vital capacity	64.7 ± 0.3	46.1 ± 1.6	0.000
(mean ± SE)	Endurance	73.3 ± 0.3	67.8 ± 1.2	0.039
	Flexibility	92.9 ± 0.2	93.0 ± 0.7	0.951

SE, standard error.

Table 4. Trend χ^2 test between physical fitness score and overweight prevalence by sex.

Sex	Item	Score (Prevalence, %)					P
		<60	60–69	70–79	80–89	90–100	
Men	Vital capacity	323 (40.2)	563 (10.5)	307 (2.3)	142 (1.4)	119 (0.8)	0.000
	Endurance	190 (28.5)	480 (17.7)	366 (11.5)	195 (7.7)	223 (3.6)	0.000
	Flexibility	10 (20.0)	149 (20.8)	300 (13.7)	344 (11.6)	651(13.1)	0.051
	Speed	284 (27.5)	656 (13.6)	243 (7.4)	144 (5.6)	127 (4.7)	0.000
Women	Vital capacity	638 (14.6)	1612 (5.0)	721 (1.5)	296 (0.7)	276 (0.7)	0.000
	Endurance	210 (9.5)	1258 (7.1)	867 (4.4)	612 (3.9)	596 (2.9)	0.000
	Flexibility	6 (0.0)	87 (2.3)	291 (6.2)	654 (5.8)	2505 (5.2)	0.944
	Speed	697 (7.6)	1687 (6.1)	783 (2.9)	262 (2.3)	114 (1.6)	0.000

Ethical Approval

Ethical approval to conduct the study, in which consent was required from all study participants, was obtained from the Ethical Committee of Inner Mongolia.

Conflicts of Interest Statement

The authors declare that they have no competing interests.

Sharing Statement

There is no additional data available.

Author Contributions

JC, ZL, JB, and JS designed the study, acquired and analysed the data, and prepared the manuscript. JS, ZL, WG, and WC assisted in the data analysis and interpretation. YE supervised the study.

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Supplementary File 1: The questionnaire about College students' behavior and health

Student ID: _____

1. **Gender :**

   1) Male 2) Female

2. **Age: _____years**

3. **Ethnicity :**

   1) 1) Han 2) Mongolian 3) Other

4. **Class years of education :**

   1) 1 2) 2 3) 3 4) 4 5) 5

5. **Monthly expenses (Yuan) :**

   1) <300 2) 300-600 3) 600-1000 4) >1000

6. **Residence :**

   1) City 2) Rural 3) Pastoral 4) Suburbs

7. **Faculty :**

   1) Clinical Medicine

   2) Public Administration and Information Management

   3) Medicine

   4) Nurse

   5) Traditional Chinese Medicine and Mongolian Medicine

   6) Other

8. **Did you have breakfast :**

   1) Yes 2) No (skipping breakfast)

9. **Gastrointestinal upset:**

   1)Yes 2)No

10. **How about your relationships:**

    1) Good 2) Medium 3) Poor

The 11-18 questions only answered by smokers

11. Number of cigarettes smoked per day :

1) <5 2) 5–9 3) >10

12. Number of smoking friends :

1) <5 2) 5–10 3) >10

13. Parent smoker :

1) Yes 2) No

14. Quit smoking (times) :

1) Never 2) 1–2 3) >3

15. The first time smoking :

1) University 2) High School 3) Junior high school

16. The attitude of your family on you smoking :

1) Opposed 2) Don't Care 3) Approve

17. An hour not smoking :

1) No discomfort 2) Can endure 3) Intolerable

18. You feel after smoking :

1) Better 2) Worse 3) No change

For the 19-35 questions, please answer "Yes" or "No" to express your opinion

19. Do not care about people smoking around you :

1) Yes 2) No

20. Smoking is a sign of civilization :

1) Yes 2) No

21. Smoking is one of the causes of air pollution :

1) Yes 2) No

22. Teachers should not smoke:

1) Yes 2) No

23. The State should take measures to stop smoking :

1) Yes 2) No

24. Eliminate smoking on campus :

1) Yes 2) No

25. Eliminate smoking in classroom :

1) Yes 2) No

26. Smoking is harmful to one's health :

1) Yes 2) No

27. Smoking is harmful to the health of others :

1) Yes 2) No

28. You is the only one child in your family:

1)Yes (only children) 2)No (sibling children)

29. You do sports at least one hour once a week:

1) Yes 2)No

30. Did you go to bed after 00:00 in the last week

1) Yes 2)No

31. Feeling stress:

1) Yes 2)No

32. I find myself very concerned about the grades I am likely to receive this semester:

1)Yes 2)No

33. I am spending a lot of time thinking about how this semester's grades could negatively affect my educational and career goals:

1)Yes 2)No

34. I am worrying a great deal about the effect this semester's grades will have on my future

1)Yes 2)No

35. I find myself very concerned about the grades I am likely to receive this semester

1)Yes 2)No

Definition:

1. Smoke: Smoked every day in the last 30 days

2. Urban: Come from city or suburb

3. Rural: Come from from village or pastoral area

4. Stay up: staying up was defined as going to bed after midnight

5. Gastrointestinal problems were defined as recurring symptoms that were significant enough to alter lifestyle or require chronic treatment

6. Stress: Occurs when an individual perceives that environmental demands tax or exceed his or her adaptive capacity.

7. We defined breakfast per the Student Nutrition Dietary Assessment, which is any food or beverage consumption between awakening and 45 minutes after the start of school. Subjects who did not consume breakfast on one of two days or neither day were categorized as breakfast skippers, while those that consumed breakfast on both days were classified as breakfast eaters.

The questions addressing smoking and their response options

1. Gender :

1**)** Male 2**)** Female

2. Ethnicity :

1) Han 2) Mongolian 3) Other

3. Class years of education :

1) 1 2) 2 3) 3 4) 4 5) 5

4. Monthly expenses (Yuan) :

1) <300 2) 300-600 3) 600-1000 4) >1000

5. Residence :

1) City 2) Rural 3) Pastoral 4) Suburbs

6. Faculty :

1) Clinical Medicine

2) Public Administration and Information Management

3) Medicine

4) Traditional Chinese Medicine and Mongolian Medicine

5) Other

For the 7-15 questions, please answer "Yes" or "No" to express your opinion

7. Do not care about people smoking around you :

1) Yes 2) No

8. Smoking is a sign of civilization :

1) Yes 2) No

9. Smoking is one of the causes of air pollution :

1) Yes 2) No

10. Teachers should not smoke:

1) Yes 2) No

11. The State should take measures to stop smoking :

1) Yes 2) No

12. Eliminate smoking on campus :

1) Yes 2) No

13. Eliminate smoking in classroom :

1) Yes 2) No

14. Smoking is harmful to one's health :

1) Yes 2) No

15. Smoking is harmful to the health of others :

1) Yes 2) No

The 16-23 questions only answered by smokers

16. Number of cigarettes smoked per day :

1) <5 2) 5–9 3) >10

17. Number of smoking friends :

1) <5 2) 5–10 3) >10

18. Parent smoker :

1) Yes 2) No

19. Quit smoking (times) :

1) Never 2) 1–2 3) >3

20. The first time smoking :

1) University 2) High School 3) Junior high school

21. The attitude of your family on you smoking :

1) Opposed 2) Don't Care 3) Approve

22. An hour not smoking :

1) No discomfort 2) Can endure 3) Intolerable

23. You feel after smoking :

1) Better 2) Worse 3) No change

Research checklist STROBE Statement

	Item No	Recommendation
Title and abstract	1	(*a*) Factors Associated with being Overweight among Inner Mongolia Medical Students in China: A Cross-sectional Questionnaire Survey
		(*b*) Background: Although many studies have investigated factors that affect obesity, in China the data for particular occupations are limited, and thus the goal of this study was to identify lifestyle factors associated with overweight in a specific population of medical students. Methods: A survey was conducted among medical students at the Inner Mongolia Medical University of China. The material consisted of three parts: students' basic information, lifestyle of students, and physical fitness data. Students BMI ≥25 was defined as overweight. Factors associated with overweight were identified using binary logistic regression analysis. Results: BMI for males was 22.1 ±2.9 and 21.2 ±2.2 for females. The prevalence of overweight was 7.6%, with the prevalence being higher for males compared to females, urban higher than rural, and being an only child higher than having sibling children. For males, urban residence was a risk factor, while for females being an only child and staying up at night were risk factors, with physical activity a protective factor. A dose-dependency relationship was found between physical fitness and overweight prevalence. Conclusions: This study shows that being an only child and resident in an urban area are risk factors, staying up late and lack of physical activities increased the risk of being overweight. BMI was associated with declines in physical fitness. Our study provides more insight into adolescent obesity problems.
Introduction		
Background/rationale	2	Obesity has increased globally among children, adolescents, and adults, worldwide, at least 2.8 million people die each year as a result of being overweight or obese with mortality rates proportional to degree of obesity. Younger age groups are affected as demonstrated in the example of American college students of whom nearly 1/3 are overweight or obese. According to the WHO, in Europe, some 30-80% of adults and about 20% of children and adolescents are overweight. The situation in Asia is better with lower prevalence of obesity reported in Japan, Thailand, and China although China is experiencing a rapid increase in the numbers of people classified as overweight or obese. With obesity becoming an overwhelming global public health issue multitude of diseases associated with it, including heart diseases, diabetes, hypertension, and certain cancers . Although obesity is less prominently associated with morbidity in adolescence it is, nevertheless, a strong precursor of obesity and related morbidity in adulthood. Adolescence has been identified as a critical period in the development of overweight/obesity patterns with the transition to college another potentially important time of risk for increases in weight among young adults. In China, obesity is on the rise with the prevalence of being overweight or obese increasing from 9.6 and 0.6%, respectively, in 1991 to 20.0 and 3.0%, respectively, in 2000 among men; for women the comparable figures showed an increase from 14.5 and 1.8%, respectively, to 26.5 and 5.2%, respectively. The causes of obesity among children and adolescents can be divided into genetic factors and lifestyle factors, which include patterns of physical activity and diet. Lifestyle is the most important factor in childhood and adolescence with some studies showing that markers of an unhealthy lifestyle, such as inactivity and skipping

		breakfast are related to overweight and obesity. However, findings are not consistent among studies, due to differences in variables such as sex, race, and region. In addition, the proportion of one-child families rising, a situation more prevalent in China since the 1970s, with the advent of family-planning policy.
Objectives	3	Associations between lifestyle and overweight have not been studied in the Inner Mongolia Autonomous Region of China, a minority centralized residence area. Consequently, a major goal of our study was to identify the associations between lifestyle factors and obesity in adolescents and young adults at risk by surveying students in Inner Mongolia Medical University. A second goal was to determine these factors differed by gender.
Methods		
Study design	4	CROSS-SECTIONALSTUDY
Setting	5	The study took place at Inner Mongolia Medical University in Hohhot China, from December 2010 to January 2011
Participants	6	Students grade 1 to 3 in Inner Mongolia Medical University (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case
Variables	7	Students who used to reside in cities or suburbs were classified as urban, while those previously residing in villages or pastoral areas were classified rural; only child was defined a person without siblings; We defined breakfast followed our previously research which is any food or beverage consumption between awakening and 45 minutes after the start of school. Subjects who did not consume breakfast on one of two days or neither day were categorized as breakfast skippers, while those that consumed breakfast on both days were classified as breakfast eaters, a sports participant was defined as a person who did sports at least 1 hour per week; staying up was defined as going to bed after midnight; a smoker was defined as a current daily smokers or occasional smoker. Gastrointestinal problems were defined as recurring symptoms that were significant enough to alter lifestyle or require chronic treatment and quality of relationships (poor, medium, good) were self-assessed.
Data sources/ measurement	8*	Grade, gender, Residential, only child, Monthly expenses, smoke, breakfast, relationship, Gastrointestinal problems, sport, stay up, ethic data was measured by self-report questionnaire. According to the National Physical Training Qualification Standards promulgated by the Ministry of Education of the People's Republic of China, students in full-time elementary, junior, senior, and secondary vocational schools, and colleges and universities must take a physical fitness test. The University group test includes 6 items of which height, weight, vital capacity, speed, flexibility and endurance. Speed score was measured by the 100 meters run; flexibility by sit and reach; vital capacity by a vital capacity meter; and endurance by a 800 m run for females and 1 km run for males.
Bias	9	The survey was carried out in the classroom.Investigators distributed questionnaires and asked students to complete the questionnaires in the classroom. Investigators were present to answer any questions regarding the questionnaire. Participants returned the completed questionnaire to investigators some of whom checked the questionnaire while others counted the number of questionnaires.

		Physical fitness test data were obtained from the school's sports department. According to the National Physical Training Qualification Standards carry out test. Before the test, a student needs to get a test card before taking the test in an established room, speed and endurance are conducted outside on a running track. Identity is verified to be consistent with the card to avoid students switching cards.
Study size	10	Nearly 6000 students in school, we carry out a general investigation.
Quantitative variables	11	t test, logistic regression
Statistical methods	12	(*a*) BMI compute by weight(kg)/height (m) ^{2} and prevalence of being overweight by gender the mean study BMI was compared with national Chinese figures using a t test. The prevalence of being overweight was then calculated using the previously enumerated lifestyle factors. Next, crude odds ratios (OR) were calculated to evaluate the risk of exposure effects in the group under study relative to the reference group and associated 95% confidence intervals (CI). A non-conditional binary logistic regression analysis was used to ascertain factors associated with being overweight. This method was used for analyses with dependent variables in two categories (in this case, overweight and normal weight). Independent variables included the enumerated lifestyle and other factors. Adjusted OR used logistic regression models to explore the relationship between the independent variables on the dependent variable in model. In the models an OR >1.0 designated increased overweight risk and OR <1.0 indicated protective factors. An independent-sample t test was used to compare physical scores in overweight vs. normal weight groups by gender. The trend chi-square test was used to ascertain any dose-dependent relationships between the prevalence of being overweight and physical fitness by gender. A significance level of p = 0.05 was accepted for all analysis.
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) missing data were less than 10%, listwise
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses

Continued on next page

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Questionnaire survey: he/she was not in the school at the survey time Physical fitness test: disability or in illness at the test time
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) University students
		(b)grade 0 missing, only child 9 missing, resident 20 missing, stay up 2 missing, smoke 0 missing, relationship 16missing, sport 8 missing, breakfast 4 missing, Gastrointestinal problems 88 missing, monthly expenses 11 missing
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time
		Case-control study—Report numbers in each exposure category, or summary measures of exposure
		5
Main results	16	1.The BMI for males was 22.1 ±2.9, and for females 21.2 ±2.2. On average, the males had a higher BMI than did the female. 2. The overall prevalence of being overweight among Inner Mongolia medical students was 7.6% in which over 13% of the students were obese. The prevalence of being overweight among males was significantly higher than among female (13.6% vs. 5.1%). 3. Male students who were prior urban residents were also at higher risk for being overweight. For female medical students, compared with those who had siblings, only children had nearly 1.5 times higher risk of being overweight; staying up late also was also associated with a similar level of risk. participating in sports for females was protective. 4. A reduced physical score was found for all items in males and 3 items (speed, vital capacity, and endurance) in females. 5. Dose-dependency relationship between overweight prevalence and physical fitness score
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	This study shows that being an only child and resident in an urban area are risk factors, staying up late and lack of physical activities increased the risk of being overweight. BMI was associated with declines in physical fitness.
Limitations	19	Lifestyle data were assessed on the basis of self-reported data only, without the use of experimental measurements. In contrast, the response rate and large number of participants are strengths of the study.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	While medical students might have knowledge regarding the consequences of inappropriate body weight, a substantial number ignore this knowledge. School administrators should encourage students to actively participate in body weight training and education to improve attitudes toward inappropriate body weight, to increase protective factors, and reduce the risk factors for inappropriate body weight, especially in only children.

Other information		
Funding	22	The research was supported by Natural Science Foundation of Inner Mongolia in China. 2013MS1193 from the Ministry of Science and Technology.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.