

Analysis on the change trend of college students' body mass index in Qingdao from 1999 to 2016

Huiwen Zhang¹, Yingfen Hu^{2*}, Yuanjie Zhang³, Xiaoyang Jiang¹, Qing Liu¹

¹Qingdao University School of Public Health, Qingdao 266000, China

²Qingdao University School of Life Sciences, Qingdao 266000, China

³Xuzhou Health Supervision Institute, Xuzhou 221000, China

Abstract: To understand the changing trend of body mass index of college students in Qingdao from 1999 to 2016. A survey of 1712 college students' weight and height from 1999 to 2016 was conducted. From 1999 to 2016, the height of boys was higher than 169cm, and the height of girls was higher than 161cm. The proportion of low-weight students with BMI<18.5kg/m² increased significantly from 2008 onwards, and the proportion of overweight and obesity college students also showed an increasing trend. Except for 2002, the proportion of overweight and obesity among boys was higher than that of girls in the same period. The weight of college students in Qingdao is polarized. The proportion of low body weight, overweight and obesity increases, and the proportion of normal weight students decreases.

Keywords: Body mass index; College students; Changing trend

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*Corresponding Author: Yingfen Hu, qingdahyf2006@163.com

1. Introduction

Since the reform and opening up, China's economy has developed rapidly and people's lifestyles have also undergone tremendous changes. College students are in the final stage of adolescent growth and development. Whether the growth and development of this period is normal, whether the body shape is symmetrical and bodybuilding, and whether a good lifestyle is formed will have an important impact on their physical and mental development and future lifestyle. Parental habits have an important impact on adolescents' physique[1]. In the early 1950s, Kraus found that the physical fitness of American college students and European students in European countries such as Switzerland and Italy was behind that of European college students[2]. James et al[3] found that obese students prefer to eat high-calorie foods such as snacks, and have a bad habit of sedentary. Japan is the country with the longest life in the world. In the process of physique survey of Japanese college students, Japanese college students have high physical health awareness. Domestic surveys on college students' physical health are mainly concentrated in Beijing, Shanghai and Guangzhou. In the past, a survey of Qufu Teachers and Shandong Normal University found that boys and girls have a higher lean rate, and obesity and overweight also account for a larger proportion. Qingdao is located in the eastern part of Shandong Province. It is a coastal city with unique climate and eating habits. The physical fitness of college students may differ from other regions. Therefore, this study used the physical fitness survey of college students from 1999 to 2016

to analyze the status quo and changes of physical fitness survey.

2. Methods

2.1. Materials

A total of 1712 college students from a university in Qingdao were studied.

2.2. Methods

According to the height and weight of the BMI, according to the WHO regulations, this study refers to the 2006 China Adult Overweight and Obesity Prevention and Control Guide[4] to determine the weight: according to BMI (kg/m²) weight classification: lean (<18.5), normal (18.5~), overweight (24.0~), obesity (≥28.0) graded all samples, both thin, normal, overweight, obese.

2.3. Statistical analysis

EXECL was entered into the data, and SPSS 20.0 was used for statistical analysis. The t-test was used to compare height, weight, and BMI of different genders. The trend of BMI change between male and female students at different times was tested by trend χ^2 test.

3. Results

3.1. General conditions

A total of 1712 college students, including 604 boys (35.3%) and 1108 girls (64.7%), with an average age of (20 ± 2) years.

Table 1 The trend of height change of college students of different genders in different years (X±S, cm)

| Gender | 1999 | 2000 | 2002 | 2003 | 2008 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------|--------------------|--------------------|---------------------|---------------------|-------------------|
| male | 37 172.88 ±6.27 | 37 172.49 ±4.82 | 71 174.82 ±6.16 | 48 170.13 ±6.43 | 57 174.05 ±5.82 | 26175.46 ±5.38 | 82 175.61 ±6.79 | 74 173.43 ±6.32 | 78 173.86 ±6.56 | 50172.52 ±10.11 | 44169.66 ±7.19 |
| female | 49 164.40 ±5.52 | 88 162.30 ±5.46 | 84 162.25 ±4.36 | 72 162.04 ±4.05 | 57 163.45 ±5.43 | 74164.00 ±4.07 | 105162.59 ±4.63 | 112163.79 ±5.72 | 272161.21 ±20.46 | 101163.39 ±12.35 | 94162.16 ±5.34 |

Table 2 The trend of weight change of college students of different genders in different years (X±S, cm)

| Gender | 1999 | 2000 | 2002 | 2003 | 2008 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| male | 37 61.68 ±8.42 | 37 64.89 ±7.71 | 71 64.89 ±7.71 | 48 60.31 ±6.38 | 57 63.58 ±6.43 | 26 69.73 ±9.70 | 8267.01 ±11.02 | 7465.84 ±10.90 | 78 63.91 ±8.51 | 5063.83 ±12.76 | 4462.68 ±13.30 |
| female | 49 56.47 ±6.05 | 88 56.74 ±5.83 | 84 52.74 ±5.83 | 72 52.79 ±5.29 | 57 54.62 ±5.44 | 74 53.73 ±5.83 | 10553.39 ±5.64 | 11254.89 ±6.68 | 27253.38 ±8.45 | 10153.82 ±9.52 | 94 52.31 ±6.99 |

3.2. Changes in the height of college students

The trend of height change of male and female college students is shown in Table 1. The average height of male students in 1999 was 172.88. The average height of male students increased from 2002 to 2012, and increased to 175.61 in 2012, and then showed a downward trend. The average height of girls in 1999 was 164.40, which was not significantly different from the average height of girls in other years.

3.3. Changes in the weight of college students

The trend of weight changes of male and female college students is shown in Table 2. The average weight of male students began to rise from 2000, and by 2011, the weight increased by 8.05kg. The average weight of female students began to decline from 2002, and the average weight decreased by 4.16 kg in 2016.

3.4. Changes in the BMI of college students

In 1999, the proportion of male obesity was 0%, overweight was 4.87%, low body weight was 8.54%, and normal body weight was 86.59%. Before 2008, this composition ratio was not obvious, but after 2008, overweight and low body weight ratios were significantly increased ($\chi^2=25.26$, $P<0.05$). In 2015, boys were overweight 22.73%, obesity was 9.09%, and low body weight was 4.55%. The body weight showed a trend of two-level differentiation, that is, fewer and fewer normal weight students. More and more students are thin and obese, see Table 3. In 1999, the proportion of obesity was 0%, overweight was 1.21%, low body weight was 10.07%, and normal body weight was 86.59%. However, the proportion of low-weight students gradually increased, reaching 23.66% in 2014 ($\chi^2=20.36$, $P<0.05$). See Table 4. Except for 2002, the obesity rate and overweight rate of male students were higher than that of female students in the same year ($P<0.05$).

Table 3 Changes in BMI of college boys from 1993 to 2016 (%)

| Group | 1999 | 2000 | 2002 | 2003 | 2008 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------------|-------|-------|-------|------|-------|-------|-------|-------|------|-------|-------|
| underweight | 8.54 | 1.68 | 5.56 | 0 | 0 | 8.33 | 11.11 | 10.34 | 16 | 4.55 | 6.67 |
| Normalweight | 86.59 | 95.80 | 94.44 | 100 | 84.62 | 66.67 | 77.78 | 86.21 | 74 | 63.64 | 86.67 |
| overweight | 4.87 | 2.52 | 0 | 0 | 7.69 | 10.42 | 8.89 | 3.45 | 8 | 22.73 | 6.66 |
| obesity | 0 | 0 | 0 | 0 | 7.69 | 14.58 | 2.22 | 0 | 2 | 9.09 | 0 |
| total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Table 4 Changes in BMI of college girls from 1993 to 2016 (%)

| Group | 1999 | 2000 | 2002 | 2003 | 2008 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| underweight | 10.07 | 12.14 | 10.71 | 20.83 | 17.24 | 27.02 | 0 | 12.36 | 23.66 | 22.77 | 12.77 |
| Normalweight | 88.72 | 87.86 | 89.29 | 75 | 79.31 | 70.27 | 96.97 | 83.15 | 39.78 | 76.24 | 76.59 |
| overweight | 1.21 | 0 | 0 | 4.17 | 3.45 | 2.71 | 3.03 | 4.49 | 2.16 | 0 | 9.57 |
| obesity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.99 | 1.07 |
| total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

4. Discussion

The school is a municipal comprehensive college, mainly recruiting students from Shandong Province. From 1999 to 2015, the average height of boys is around 172cm, which is higher than the national average of 171.9cm in 2005[5]. The average height of girls is about 161cm, which is consistent with the height and weight of Beijing college students. The average height of college students in Qingdao is lower than that of American college students by 176.3cm[6], which is close to the height of European college students, such as 174.1cm in France[7],

174.48cm in Italy and 175.3cm in Spain[8], which is higher than that in Japan. 170.5cm[9]. The average height of girls among college students is close to that of the United States[6]. The overall trend of college students in Qingdao from 1999 to 2016 was that boys and girls increased in leanness, overweight and obesity. The number of students with normal weight decreased and the body weight showed a trend of polarization. In recent years, with the rapid development of the economy, the growth and development level of Chinese children has shown a rapid and steady upward trend. This rising trend is not only reflected in height, but also the body mass

index (BMI)[10].

This study found that the height of college students changed from 1999-2016 to a parabolic type. In 1999, the average height of boys was 172.88. The average height of boys increased from 2002 to 2012, and increased to 175.61 in 2012, and then showed a downward trend. The weight of boys has shown an upward trend from 1999 to 2016, while girls have shown a downward trend. From the trend of BMI, the obesity rate and the leanness rate of boys and girls generally showed an upward trend. At the same time, the obesity rate of boys was higher than that of girls. In 2015, boys were overweight 22.73%, obesity 9.09%, low body weight was 4.55%, the female skinny rate reached 23.66% in 2014, the males' skinny rate was lower than the national college students' level (14.7%), while the female's skinny rate was higher than the national level (22.3%). However, the results of surveys in other regions of the country are lower, such as the male students' thinness rate of 50.8% in Chengdu and 57.2% in female students[11]; the male students' thinness rate in Xi'an is 41.6%, and that of female students is 46.6%[12], 2003 Shanghai college students are 19.2% and girls are 29.4%[13,14]. The increase in leanness may be related to the society's ethos of thinness and beauty, which leads to college students dieting excessive weight loss. In addition, the increase in the lean rate of college students may also be due to the State Council's May 7th, 2007 issue of the "Opinions of the Central Committee of the Communist Party of China on Strengthening Youth Sports to Enhance the Physical Fitness of Young People", requiring schools to encourage students to exercise for one hour every day to promote student physical fitness. Health, which has a milestone significance in preventing adolescent obesity[15]. According to the 2010 survey data, the detection rate of adolescents who can exercise for one hour per day is 22.7%[16]. Located in the eastern part of Shandong Province, Qingdao is a beautiful coastal city. In recent years, its economic growth has grown by leaps and bounds. In 1999, the total production value of Qingdao was 99.283 billion, and it increased to 1,018.848 billion in 2016. Economic growth means an improvement in people's living standards, and this study also found that the overall trend of obesity in 1999-2016 was an increase in the detection rate. According to the "Report on Nutrition and Chronic Diseases of Chinese Residents (2015)", the overweight rate of adults aged 18 and over in China was 30.1%, and the obesity rate was 11.9%, which was 7.3% and 4.8% higher than that in 2002[17]. There are also reports that students can increase their average body weight by 3.6% during the four years of college[18]. The study found that more than two-thirds of college students in the United States experience weight gain during school hours [19,20].

5. Conclusion

In summary, looking at the results of the survey of college students in the region for nearly 20 years, the BMI, obesity rate and the female's leanness rate are obviously rising, and the normal weight ratio is getting lower and lower, showing a form of polarization. In today's society, more leisure and entertainment, less exercise, less words, and a fast-food lifestyle seriously affect the physical and mental health of college students in the region, which is also not conducive to the improvement of academic performance. It is suggested that we should strengthen the health education for college students and guide them to develop a normal weight concept. At the same time, they should give reasonable dietary guidance to obese and lean college students, and encourage college students to increase outdoor activities and reduce the time of using electronic products indoors.

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