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Poor Physical Performance is Associated with Obesity Among University Students in China

Authors' Contribution:

Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Background:

The aim of this study was to explore the relationship between physical performance and BMI (body mass index) of university students in China.

Material/Methods:

We conducted a cross-sectional study evaluating the physical performance and BMI of university students. BMI was calculated based on height and weight. Overweight and obesity were defined by the Working Group on Obesity references in China.

Results:

A total of 2313 participants (978 males and 1335 females) were recruited in our study. The mean value of the 50-meter dash and standing long jump in male students was higher than in female students ($P < 0.05$). The overall prevalences of overweight (including obesity) and obesity for male students were 17.9% and 4.2%, respectively, and 5.1% and 0.5%, respectively, for female university students. BMI was weakly positively associated with the 50-meter dash score, but was negatively associated with the score for standing long jump and pull-ups.

Conclusions:

Our study suggested that overweight and obesity are associated with physical performance of university students, especially in male students. University students should exercise more to improve physical health.

MeSH Keywords:

Motor Activity • Obesity • Students, Medical

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Background

The prevalence of underweight in university students is still high [1]. Overweight poses health risks to university students, such as high blood pressure [2], psychosocial stress [3], adverse cardiovascular outcomes [4], and forced vital capacity [5,6].

Some researcher found that BMI was a predictor of good physical function, with underweight was more of a limiting factor than overweight [7]. Another study by Leyk et al. [8] also revealed that body weight increases and fitness decreases in non-obese young adults in Germany.

In the current study, we aimed to explore whether a relationship exists between physical performance and BMI among university students.

Material and Methods

Participants

A school-based study was performed for university students who underwent physical fitness testing in 2012. A physical performance test was administered as part of an exercise class. Participants were 2313 subjects (978 male and 1335 female) aged 19–23 years. Written informed consent was obtained

from all participants, and the study was approved by the local Ethics Committee.

Physical-fitness-test

All students performed the standing long jump 3 times, and the best result was recorded. We also recorded the time for the 50-meter dash for all students, as well as the number of pull-ups for male students and number of sit-ups for female students. Abdominal strength was assessed using a 60-second sit-up test.

Anthropometric measurements

Based on a previous study [5], we performed anthropometric measurements and defined overweight and obesity.

Statistical analysis

R was used for describing physical performance and BMI of university students. Analysis of variance was used for comparison of physical performance among different variables. The distribution of body type between male and female students was compared using the chi-square test. P values less than 0.05 were considered as statistically significant. A bar graph was draw for the physical performance among body types in university students.

Table 1. Character of included subjects.

Variable		Frequency	Percent
Gender	Male	978	42.30
	Female	1335	57.70
Age (year)	19	162	7.00
	20	720	31.10
	21	845	36.50
	22	442	19.10
	23	144	6.20
Body type	Underweight	505	21.80
	Normal	1564	67.60
	Overweight	196	8.50
	Obesity	48	2.10

Table 2. Comparison of measurement value for physical performance between male and female students.

Variable	Male		Female		t	P
	Mean	SD	Mean	SD		
50 meter dash (second)	7.99	1.21	9.83	1.10	37.80	0.00
Standing long jump (meter)	2.28	0.21	1.68	0.17	75.80	0.00

Table 3. Measurement value of physical performance among different age in male students.

Variable		Mean	SD	Minimum	Maximum
50 meter dash (seconds)	19	7.91	1.178	6.20	13.00
	20	7.97	1.16	6.00	14.00
	21	7.96	1.12	6.20	13.40
	22	8.06	1.44	6.50	18.90
	23	8.15	1.31	6.50	14.00
	Total	7.99	1.21	6.00	18.90
Standing long jump (meter)	19	2.26	0.22	1.72	2.80
	20	2.28	0.21	1.60	2.82
	21	2.29	0.20	1.60	2.78
	22	2.28	0.22	1.20	2.70
	23	2.28	0.21	1.38	2.62
	Total	2.28	0.21	1.20	2.82
Pull-up	19	4.02	3.89	0.00	24.00
	20	3.47	3.32	0.00	20.00
	21	3.89	3.41	0.00	22.00
	22	4.81	4.59	0.00	45.00
	23	5.32	3.82	0.00	14.00
	Total	4.03	3.74	0.00	45.00

Table 4. Measurement value of physical performance among different age in female students.

Variable		Mean	SD	Minimum	Maximum
50 meter dash (seconds)	19	9.81	1.04	7.90	14.30
	20	9.87	1.16	6.20	14.20
	21	9.78	1.07	7.10	15.00
	22	9.84	1.08	7.70	14.30
	23	9.87	1.21	8.30	15.00
	Total	9.83	1.10	6.20	15.00
Standing long jump (meter)	19	1.63	0.17	1.10	2.05
	20	1.68	0.17	1.03	2.52
	21	1.68	0.18	0.95	2.46
	22	1.69	0.16	1.00	2.18
	23	1.70	0.14	1.35	1.98
	Total	1.68	0.17	0.95	2.52
Sit-ups	19	26.52	7.01	0.00	40.00
	20	26.82	7.31	0.00	48.00
	21	27.10	7.27	0.00	50.00
	22	26.45	6.48	6.00	44.00
	23	24.94	7.82	0.00	37.00
	Total	26.72	7.16	0.00	50.00

Table 5. Comparison measurement value of physical performance among different body types in male students.

Variable		Mean	SD	Minimum	Maximum
50 meter dash (seconds)	Underweight	7.92	1.00	6.20	12.00
	Normal	7.93	1.26	6.00	18.90
	Overweight	8.24	1.22	6.50	14.00
	Obesity	8.48	0.89	7.20	11.30
	Total	7.99	1.21	6.00	18.90
Standing long jump (meter)	Underweight	2.30	0.19	1.82	2.82
	Normal	2.30	0.20	1.20	2.80
	Overweight	2.20	0.21	1.60	2.74
	Obesity	2.07	0.24	1.38	2.48
	Total	2.28	0.21	1.20	2.82
Pull-ups	Underweight	5.20	3.97	0.00	24.00
	Normal	4.39	3.77	0.00	45.00
	Overweight	2.07	2.28	0.00	10.00
	Obesity	0.76	1.68	0.00	8.00
	Total	4.03	3.73	0.00	45.00

Table 6. Comparison measurement value of physical performance among different body type in female students.

Variable		Mean	SD	Minimum	Maximum
50 meter dash (seconds)	Underweight	9.84	1.12	7.10	15.00
	Normal	9.81	1.11	6.20	15.00
	Overweight	10.02	1.00	8.30	14.00
	Obesity	9.73	0.72	8.70	10.60
	Total	9.83	1.10	6.20	15.00
Standing long jump (meter)	Underweight	1.70	0.17	1.00	2.12
	Normal	1.68	0.17	0.95	2.52
	Overweight	1.62	0.17	1.20	1.97
	Obesity	1.65	0.25	1.10	1.84
	Total	1.68	0.17	0.95	2.52
Sit-ups	Underweight	26.48	7.16	0.00	45.00
	Normal	26.98	7.12	0.00	50.00
	Overweight	24.37	6.75	0.00	36.00
	Obesity	26.86	12.71	0.00	38.00
	Total	26.72	7.16	0.00	50.00

Results

A total of 2313 participants (978 males and 1335 females) ages 19–23 years were enrolled in our study. The mainly characteristics of subjects are shown in Table 1. Table 2 shows a

comparison of measurement values for physical performance between male and female students. The measurement value of 50-meter dash and standing long jump in male students was higher than in female students ($P<0.05$). Tables 3 and 4 show that there was no difference for measurement value of

Figure 1. Comparison of measurement values for 50-meter dash among students with different body types.

Figure 3. Comparison of measurement values of pull-ups for male students with different body types.

Figure 2. Comparison of measurement values of standing long jump for male students with different body types.

physical performance among different ages by sex. Tables 5 and 6 compare measurement values for physical performance among different body types by sex. A significant difference was found for physical performance among different body types in male students but not in female students (Figures 1–3). Table 7 shows the prevalence of underweight, overweight, and obesity of university students. The overall prevalences of underweight, overweight (including obesity), and obesity for male university students were 13.6%, 17.9%, and 4.2%, respectively; and for female university students they were 27.5%, 5.1%, and 0.5%, respectively. BMI was positively associated with the 50-meter dash score and negatively associated with the standing long jump and pull-up scores (Table 8).

Table 7. Proportion of body type by gender.

Body type	Male		Female		Chi-square	P
	Frequency	Percent	Frequency	Percent		
Underweight	133	13.60	372	27.90	144.06	0.00
Normal	670	68.50	894	67.00		
Overweight	134	13.70	62	4.60		
Obesity	41	4.20	7	0.50		

Table 8. Correlation of physical performance and BMI.

Physical performance item		BMI	
		r	P
Male	50 meter dash (seconds)	0.09	0.00
	Standing long jump (meter)	–0.27	0.00
	Pull-ups	–0.33	0.00
Female	50 meter dash (seconds)	0.00	0.97
	Standing long jump (meter)	–0.03	0.30
	Sit-up	–0.01	0.78

Discussions

The present study shows that the higher overall prevalence of underweight, overweight (including obesity), and obesity of university students still exists. BMI was weakly positively associated with the 50-meter dash score, but was negatively associated with the standing long jump and pull-up scores.

We also found that the measurement value of 50-meter dash and standing long jump in male students was higher than in female students ($P < 0.05$). Subgroup analysis found significant differences for measurement value of physical performance among different body types in male students but not in female students. The possible reason may be that the relationship between physical performance and BMI can vary by sex. Although some researcher found males had a worse physical fitness than females, comparison between males and females is difficult due to innate physiological differences. Although students of medicine and related disciplines are aware of the importance of proper diet and adequate levels of PA in health, they did not translate theory into practice [9].

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There are also some shortcomings in the present study. We did not control for possible confounding factor such as diet and behavior. Exclusion of individuals who were unable to complete the test may have led to bias. School-based studies cannot confirm a causal link between physical performance and BMI. Measurement of physical performance, height, and weight is easy and safe, and is also widely used worldwide.

Conclusions

Our study suggests that overweight and obesity have an influence on physical performance of university students, especially in male students. University students should perform adequate exercise to improve physical health.

Conflict of interest

None declared.