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Effects of Fitness App-Based Slow Jogging Intervention on Physical Fitness among Chinese Obese College Students

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Abstract

Obesity has become a global public health problem, and it has become more and more prominent among Chinese college students. The detection rate of obesity among college students is increasing year by year due to a lack of physical activity and an unhealthy lifestyle. While fitness apps are well developed and slow jogging is an emerging form of exercise with many advantages, there is a lack of research on combining the two for obese college students. This study aimed to evaluate the effects of a 12-week fitness app-based slow jogging exercise program on the physical fitness of obese college students. 131 obese college students were recruited and divided into an experimental group (66) and a control group (65) according to BMI, and the experimental group received the fitness app-based slow jogging intervention. The results showed that the intervention resulted in a significant decrease in body shape indicators such as weight, BMI, waist circumference, hip circumference and waist-hip ratio, and a substantial increase in VO_2 max and sit-up performance. Still, the intervention effect was not significant in grip strength and sit and reach, which provided a scientific basis for the management of obesity in university physical education.

Keywords: Fitness App, Slow Jogging, Physical Fitness, Obese College Students

Introduction

Obesity, as a chronic disease, occurs when the energy intake of nutrients exceeds energy expenditure and is characterized by an increase in body fat mass relative to lean body mass (Pfisterer et al., 2022), with the common types including hereditary obesity, secondary obesity, and simple obesity (Wang et al., 2022). Nowadays, obesity has become a serious public health problem worldwide. It is estimated that more than 1 billion people are obese, including 650 million adults, 340 million adolescents, and 39 million children, and the number

continues to rise. The World Health Organization (WHO) predicts that by 2025, about 167 million adults and children will be impaired by overweight or obesity (WHO, 2022).

In China, the problem of obesity is also not to be underestimated. Between 2015 and 2019, children under 6 years old accounted for 6.8% overweight and 11.1% obese; children and adolescents aged 6 - 17 years old accounted for 7.9% overweight and a certain percentage of obesity; and adults aged 18 years old and above accounted for 34.3% overweight and 16.4% obese (Pan et al., 2021). The results of the Eighth Survey on the Physical Health of Chinese Students show that the physical health standards of college students have not improved, and the phenomenon of overweight and obesity has become more and more serious, with the detection rate increasing year by year (Department of Physical Health and Arts Education Ministry of Education, 2021). This is mainly attributed to the lack of physical activity, preference for high-calorie diets, and unhealthy lifestyles of college students.

The lack of physical activity is particularly pronounced among college students. A large study of smartphone apps across 111 countries showed that college students experienced a significant reduction in physical activity during the transition to college, more so than is the case with aging in general (Muntaner-Mas et al., 2021). The characteristics and time constraints of college life are major factors, and with the transition from adolescence to college inherently characterized by physical inactivity (Kwan et al., 2012), and early adulthood (18-25 years) being a critical period for the onset of obesity (Banna et al., 2022), it is imperative that interventions be implemented to promote physical activity in this population (Pfisterer et al., 2022; Zengin & Kirkbir, 2021).

Fitness apps have gained widespread attention as tools to promote physical activity (Alturki, 2016; Dute et al., 2016; Wei et al., 2021). The American College of Sports Medicine (ACSM) survey revealed that mobile exercise apps and sports mental health research made their debut in the top ten in the “ACSM Global Fitness Trends 2024: Future Directions for the Health and Fitness Industry”, ranking seventh and eighth, respectively (ACSM, 2023). In China, the mobile sector is growing rapidly, with 1.067 billion users and an average of 26.7 hours online per week (CNNIC, 2023), providing favorable conditions for the development and application of mobile fitness applications.

Slow-jogging is a unique form of exercise, proposed by Prof. Hiroaki Tanaka of Fukuoka University in Japan, which is slower than the preferred transition speed (PTS) for amateurs or beginners (Tanaka & Jackowska, 2019). Slow-jogging has a small stride length, low heart rate, high frequency of occurrence, moderate intensity of exercise that allows one to remain relaxed while exercising, and a speed that is typically 6 - 8 km/hour, which is between jogging (8 - 10 km/hour) and walking (5 - 6 km/hour). It is highly recognized by scholars for aerobic fitness and weight loss as it not only provides the health benefits of conventional jogging, but also has a more effective fat burning effect and is less likely to cause lactic acid accumulation (Kumar, 2014). However, there are fewer studies on slow-jogging on physical fitness.

Currently, obesity is a growing problem among college students. Mobile fitness apps are developing well, and slow-jogging has many advantages, but there is a gap in research on combining fitness apps with slow-jogging for obese college students. This knowledge gap needs to be filled because it is not only relevant to the health and quality of life of obese

college students but also critical to the development of scientific and effective obesity management strategies in university physical education. The purpose of this study was to evaluate the effects of a 12-week fitness app-based slow-jogging exercise program on the physical fitness of obese college students, with the expectation that it would provide a key scientific basis for obesity management in university physical education, help improve the health of obese college students, and promote the development of university physical education in the field of obesity intervention.

Materials and Methods

Subjects

Participants were recruited from a local university. Inclusion criteria were as follows: between ages of 18-25 years; BMI ≥ 28 kg/m² or waist circumference > 0.9 cm for males and > 0.8 cm for females; and the ability to engage in slow-jogging exercise. Exclusion criteria: participants enrolled in other weight loss programs; participants with chronic diseases or sports injuries. After being fully informed about the purpose and requirements of the study, participants signed a written informed consent form, which was reviewed by the Ethics Committee of the University of H. Approval number HHJTIRB-202407-001.

Research Procedures

G*power is used to calculate the experimental sample size(Faul et al., 2007).Based on the calculations it was known that the sample size was not less than 128. After screening, 131 eligible subjects were included in this study. This study was a quasi-experimental study, which was divided into two groups, the experimental group (N=66) and the control group (N=65), based on the baseline data BMI values. The experimental group received a 12-week fitness app-based slow jogging exercise intervention, with both groups completing baseline data measurements at week 1 and again at the end of week 12. Students in the experimental group were asked to complete a minimum of 4 times exercises per week, with a 5-minute pre-exercise warm-up session and a 5-minute post-exercise cool-down session, each time lasting no less than 30 minutes. Routine exercise was sufficient for the control group.

Test Content

Before the pre-intervention assessment, subjects were invited to the Physical Fitness Testing Center to familiarize themselves with all the tests and exercises and to sign a written informed consent. A baseline assessment was completed with the following tests: height, weight, BMI, waist circumference, hip circumference, waist-to-hip ratio, grip strength, 12-minute run(VO_2 max), sit-ups, and sit and reach.

Testing Instrument

The test items conducted at the Student Physical Fitness and Health Testing Center of University H. Height, weight and BMI measured by height and weight tester SKJY (SK-2W400), waist and hip circumference measured by a soft ruler, grip strength measured by SENSSUN (EH101), sit-ups by counting, and the 12-minute run test recorded by a fitness app and sit and reach measured by SKJY (SK-2W400).

Statistical Analysis

Data were expressed as mean ± standard deviation and analyzed using SPSS 27.0. Kolmogorov-Smirnov(K-S) was used to assess the normality of the data, and a independent

sample t-test was used to compare the results before and after the intervention. The significance level tests were set at $p < 0.05$.

Results

Participants

In this study there were a total of 131 participants, including 32 females and 99 males. Age(years) for males was 19.49±1.18 and for females was 19.44±1.01. Height(cm) for EG =172.21±7.2 and for CG= 171.08±8.9, P>0.05,There was no significant difference.

Baseline data before the intervention showed that the mean age, height, weight,BMI, HC, WC, WHR, VO_2max, Grip, Sit up and Sit and reach for EG and CG, P>0.05， There was no significant difference(Table 1).

Table 1

Characteristics of the Participants

Variables	EG(n=66)	CG(n=65)	t	p
Age	19.55±1.10	19.42±1.18	0.652	0.516
Height(cm)	172.21±7.2	171.08±7.9	0.859	0.392
Weight(kg)	91.46±12.45	91.01±11.96	0.214	0.831
BMI	30.86±3.92	31.19±4.05	-0.465	0.643
WC(cm)	101.98±9.71	102.18±9.44	-0.119	0.905
HC(cm)	117.70±7.62	112.95±8.19	-0.186	0.853
WHR	0.90±0.06	0.90±0.05	-0.007	0.994
VO_2 max	24.64±6.4	25.69±4.5	-1.094	0.276
Grip(kg)	41.76±10.39	41.17±9.29	0.343	0.732
Sit up(n)	13.97±4.85	15.38±6.74	-1.377	0.171
Sit and reach(cm)	11.95±7.49	13.72±5.31	-1.556	0.122

Note: EG=experiment group; CG=control group;BMI=body mass index; WC=waist circumference;HC=hip circumference;WHI=Waist to Hip Ratio;VO_2max=maximal oxygen uptake.

Physical Fitness

It conducted a Kolmogorov-Smirnov test to examine whether the sample data follows a normal distribution. Specifically, weight, BMI, WC, WHR, VO_2 max, grip and sit-up showed significance ($p<0.05$); therefore, they did not conform to normality, and the results were analyzed using a non-parametric test(Mann-Whitney).

In addition, HC and sit and reach did not present significance ($p>0.05$); therefore, they conformed to a normal distribution and were analyzed using a independent sample t-test for the results analysis.

Table 2
Independent Samples t-test

Index		**EG(*n*=66)**	**CG(*n*=65)**	**t**	**p**
HC	Pre	112.70±7.62	112.95±8.19	-0.186	0.853
	Post	109.23±7.03	112.29±8.23	-2.293	0.023*
Sit and reach	Pre	11.95±7.49	13.72±5.31	-1.556	0.122
	Post	14.90±7.12	14.37±6.26	0.450	0.653
* p<0.05 ** p<0.01					

Note: HC: hip circumference; EG: experiment group; CG: control group.

As can be seen from Table 2, the pretest values of HC and sit and reach in the experimental and control groups did not present significance, p>0.05. After the 12-week exercise intervention, the HC of the experimental group was M=109.23cm, SD=7.03, and that of the control group was M=112.29cm, SD=8.23, Hip circumference showed a significant decrease after the intervention, mean difference(MD)=3.47cm, t=-2.293, p<0.05, presenting a significant difference; Sit and reach in the experimental group was M=14.90, SD=7.12 and the control group was M=14.37, SD=6.26, There was a significant increase in sit and reach after the intervention, mean difference(MD)=2.95cm, t=0.450, P>0.05, did not present significant difference. Thus, HC had inter-group differences, while sit and reach was not significant.

Table 3
Non-Parametric Test Analysis(Mann-Whitney)

Index		**Group M(P25, P75)**		***U***	***z***	***p***
		EG(*n*=66)	**CG(*n*=65)**			
Weight	Pre	89.50(82.6,98.7)	87.70(82.9,98.2)	2069.500	-0.348	0.728
	post	84.75(78.7,93.1)	87.40(87.4,98.0)	1653.000	-2.265	0.024*
BMI	Pre	30.25(28.0,33.4)	30.30(28.4,33.5)	2069.500	-0.348	0.728
	Post	28.7(26.8,31.5)	30.65(28.5,33.6)	1448.500	-3.206	0.001**
WC	Pre	101.5(93.8,109.0)	102.0(96.0,107.5)	2131.500	-0.062	0.950
	Post	93.5(89.0,102.3)	100.0(93.5,108.0)	1409.000	-3.391	0.001**
WHR	Pre	0.90(0.85,0.95)	0.91(0.88,0.94)	2048.000	-0.448	0.654
	Post	0.87(0.83,0.92)	0.91(0.87,0.94)	1464.000	-3.140	0.002**
VO_2 max	pre	24.60(20.4,28.9)	26.8(22.5,28.9)	1821.000	-1.502	0.133
	post	28.90(24.6,35.3)	24.6(22.5,28.9)	1296.000	-3.938	0.000**
grip	pre	41.00(34.3,50.0)	42.1(33.7,47.3)	2062.000	-0.382	0.702
	post	43.65(35.8,50.1)	42.0(34.3,45.3)	1734.500	-1.890	0.059

Index		Group M(P25, P75)		*U*	*z*	*p*
		EG(*n*=66)	CG(*n*=65)			
Sit-up	pre	14.0(11.0,17.0)	15(12.0,18.5)	1835.500	-1.428	0.153
	post	17.5(14.8,22.3)	15.0(12.5,20.0)	1669.000	-2.195	.028*
* p<0.05 ** p<0.01						

Note: EG=experiment group; CG=control group;BMI=body mass index; WC=waist circumference;WHR=Waist to Hip Ratio;VO_2 max=maximal oxygen uptake.

The experiment and control groups were compared by using the Mann-Whitney test to see if there was a significant difference between the experimental and control groups on eight variables: weight, BMI, waist circumference, waist-hip ratio, VO_2 max, grip and sit-up. For each variable, the median and the inter-quartile spacing (p25, p75) were given, and the statistics U-value, z-value, and the corresponding p-value obtained from the Mann-Whitney test were also shown.

From the table, it can be seen that the pretest data, p>0.05, were not statistically significant and did not present significance. After 12 weeks, it can be seen that weight, BMI, WC, WHR, VO_2 max, and sit-up presented significance, P<0.05. However, the P value of grip strength was greater than 0.05, with no significant difference.

Discussion

The study showed that obese college students have a significant improvement in weight, BMI, waist circumference, hip circumference, waist-to-hip ratio, VO2 max, and sit-ups after a 12-week fitness app-combined ultra-jogging exercise intervention. The implementation of fitness app-based slow-jogging exercise in extracurricular physical activity at university, especially for the obese population, showed multiple advantages. First, significant reductions in body weight, BMI, waist circumference, hip circumference, and waist-to-hip ratio are consistent with the findings of existing studies (Choi & Chae, 2020; Ma, 2022). Several studies have shown that slow jogging exercise has a significant advantage in weight control, especially in obese populations. This may be related to the prolonged aerobic nature of the exercise, which can significantly increase energy expenditure in a short period and continue to increase metabolic rate after training (Kumar, 2014). Second, in terms of fitness improvement, significant improvements in maximal oxygen uptake and sit-ups further demonstrate the effectiveness of the fitness app-based slow jogging exercise intervention, which is consistent with their findings (Hosiso et al., 2013; Lu, 2023; Wu & Zhang, 2023). In the present study, significant improvements in sit-ups reflected improved muscular endurance in obese individuals; furthermore, improvements in maximal oxygen uptake(VO_2 max) indicated enhanced aerobic endurance. However, the intervention did not significantly improve grip strength and sit and reach performance, possibly because the fitness app-based slow jogging exercise focused primarily on improving overall aerobic endurance, with less direct effects on muscular strength (Hollerbach et al., 2021) and flexibility (Guo, 2019; Muntaner-Mas et al., 2021), consistent with the present results of this study.

Limitation

The results of this study further validate the effectiveness of the fitness App-based slow jogging intervention as a physical health improvement strategy for obese college students. However, there are still some limitations. First, the sample size was relatively small, and the population was limited to a specific group of college students. Therefore, caution should be exercised when generalizing and applying it to a wider population. In addition, the intervention period was 12 weeks, and it was impossible to assess the long-term effects of the fitness App-based slow jogging intervention. Future studies should expand the sample size to include participants of different ages and higher education institutions to increase the generalization and extrapolation of the findings.

Conclusion

The results of this fitness app-based slow jogging exercise intervention study for obese college students showed multidimensional effects. In terms of body shape-related indicators, weight, BMI, waist circumference, hip circumference, and waist-to-hip ratio decreased significantly, which is important for obese college students to improve their body shape and health, indicating that the slow jogging exercise intervention is an effective way to help obese college students with weight management and body shape. Meanwhile, VO_2 max and sit-up performance were significantly improved after the intervention, reflecting the positive effects of the intervention on the development of cardiorespiratory fitness and muscular endurance, and providing a feasible program for obese college students to enhance their physical fitness. However, the post-intervention changes in body grip strength and sit and reach did not reach statistically significant differences, which implies that the slow jogging exercise intervention has not yet achieved an effective effect on these specific indicators.

Considering the health needs and exercise potential of the special group of obese college students, future research can focus on the following directions. On the one hand, we can explore how to adjust the slow jogging intervention program, such as developing a more precise exercise program based on the metabolic level and exercise capacity of obese college students, and further exploring the possible positive effects of slow jogging on indicators such as grip strength and sit and reach. On the other hand, we can study the differentiated responses of college students with different obesity levels to the fitness App-based slow jogging exercise intervention, as well as the far-reaching effects of long-term adherence to the intervention on the mental health and lifestyles of obese college students, to build a more comprehensive and targeted exercise intervention system to help obese college students achieve the overall development of physical and mental health.

Contribution

Theoretically, it reveals the mechanism of the effect of exercise intervention on the physical fitness indexes of obese students, provides scientific basis for understanding the adaptive changes of the organism under exercise stimulation, further enriches the theories of exercise physiology and physical health, and builds a solid foundation for the subsequent research. Practically, the research results provide scientific guidance for school physical education, help schools customize physical education courses for obese students, improve the physical fitness of obese students through a reasonable combination of fitness apps and aerobic exercise, and promote university physical education to pay attention to individual differences and promote the overall healthy development of all students.

Competing Interests
The authors have no relevant financial or non-financial interests to disclose.

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