

# Effect of Aerobics Movement on Cognitive Ability of Obese Adolescents

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## Abstract

**Objectives:** The objective was to explore the influence of aerobic exercise on the cognitive ability of obese adolescents. **Methods:** Fifty-six obese adolescents were selected as the research object, with 28 cases in the control group and 28 cases in the observation group. The normal learning were prepared for the obese adolescents in the control group, and aerobics, diet, and comprehensive educational intervention therapy were provided for the obese adolescents in the observation group. Moreover, the neurocognitive function of two groups of obese adolescents was assessed by a multidimensional neuropsychological test. **Results:** After comprehensive intervention of calisthenics, diet, and education, the body mass index, body weight, systolic blood pressure, and white light reaction in the observation group were significantly better than those in the control group, and the differences were statistically significant ( $P < 0.05$ ). At the same time, the cognitive ability test, Raven's reasoning test, scores were significantly better than those of the control group. Moreover, intuitive discrimination, similar comparison, and analogy reasoning were statistically significantly higher than those of the control group, and the difference was statistically significant ( $P < 0.05$ ). **Conclusions:** The comprehensive intervention of aerobics for obese adolescents can obviously improve their cognitive ability and has practical significance.

**Keywords:** Aerobics, calisthenics, cognitive ability, educational intervention, multidimensional

## INTRODUCTION

Obesity is an independent risk factor for cardiovascular, cerebrovascular, and metabolic diseases. It can lead to a series of health problems from childhood to adulthood. At present, obese adult diseases are becoming more and more common among adolescents. In addition to long-term health risks, obese adolescents also face severe mental and psychological disorders. It was found that the nerve cell repair function of fat carrier opal E decreases in obese people and the cognitive function decreases as a result of brain white matter lesions. The increase in body mass index (BMI) is closely related to the decrease of brain capacity. Obesity is closely related to cognitive decline in middle-aged and elderly people. It suggests that obesity may lead to neurological damage and cognitive impairment in patients.<sup>[1]</sup> Studies have shown that long-term aerobic exercise can improve lipid metabolism, regulate the function of endocrine system, promote fat decomposition, and improve heart function. Regular participation in physical exercise, under the effect of a large number of human-to-human transmission and information transmission, will inevitably

lead to changes in the morphology of central neurons; at the same time, due to the improvement of blood flow circulation, neurons are provided with adequate nutrition and oxygen supply, which provides a material basis for the morphological structure transformation of neurons. Therefore, few studies have reported whether calisthenics exercise can have beneficial effects on the cognitive function and other advanced neural work ability of obese adolescents. The purpose of this study is to explore the changes of cognitive ability of obese adolescents before and after comprehensive exercise intervention through comprehensive exercise intervention.

## Overview

Students from Henan health and weight-loss summer camp in 2017 were selected as the study participants. All participants were measured by a uniform standard of height and weight. In strict accordance with the inclusion criteria and exclusion

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criteria selection may mean a total of 200 participants (male 18, female 82), with BMI as obesity decision criteria, ultimately determine the 52 obese adolescents (male 30, female 22). According to the principle of 1:1 matching on the basis of informed consent, then choose summer camp for BMI judged to be normal weight, age, height, gender matched healthy controls of 52 (male 30, female 22). All participants were right handed. There was no history of spermatorrhea, neuropathy, family history, brain trauma, brain surgery, high blood pressure, and diabetes. The basic information is shown in Table 1.

## METHODS

Height and weight were measured using a height and weight meter, and BMI value (weight/height) was calculated. The thickness of sebum in the upper arm, the lower arm angle, and the abdomen were measured with a pleat thickness meter. Blood pressure was measured by a routine cuff sphygmomanometer and the rest was measured 15 minutes before. Obesity was screened by the “Chinese school-aged children and adolescents overweight and obesity screening criteria” established by the Institute of Child and Adolescent Health of Peking University in 2003.

Raven reasoning test, test, including determination of subjects perceived discrimination (Class A), comparison of similar ability (Class B), comparative reasoning (C), (D) series of skills and abstract reasoning ability (E) and reasoning intelligence quotient (N0). Each participant completed the graph reasoning problem independently for 40 min, and the test site remained quiet. The main subject did not give suggestive speech to other subject. The intelligence test items are the digital breadth test (back to back), block diagram test, arithmetic test, and mapping test.<sup>[2]</sup>

The comprehensive intervention measures of calisthenics refer to the EON Performance Solutions' (EONPS) weight-loss project and make appropriate modifications. The specific methods are as follows: in obese adolescents, according to height, weight, age, sex, blood lipid, body composition, blood pressure, and related detection by nutrition catering and exercise intensity, calculate each their total calories and

nutrients' intake. In comprehensive intervention for 1 week, total quantity of heat to maintain in 3360–4200 kJ/day, a week after an increase of 420 kJ/day, until up to 5460–6720 kJ/day; the proportions of breakfast, lunch, and dinner are 25%, 45%, and 30%, respectively. The proportion of each food category is as follows: fat 25%–30%; protein 20%–25%; and staple carbohydrates 50%; fish, beef, milk, and bean products are the main sources of protein, and provide sufficient fresh vegetables, fruits, and water every day. First of all, through lectures and publicity of pictures, aerobics enables obese teenagers to understand the definition and harm of obesity and understand the effect of effective and continuous exercise on weight loss. Master the way, time, speed, and heart rate control of aerobic exercise.<sup>[3]</sup> The sports mode is mainly antagonistic, coordinated, and time intensive, supplemented by resistance training.

## Health education

Health educational programs are regularly held one lecture per week, mainly aiming at the existing problem and obese adolescents' bad behavior intervention, including obesity, the cause of formation of how to control body weight, BMI calculation and evaluation, the kinds of food and nutrition value of scientific exercise, and reasonable diet. At the same time, a small manual on obesity knowledge is issued to promote education.

## Psychological correction

Use psychological knowledge to analyze the behavioral characteristics of obese people's overeating behaviors, adopt psychological measures to correct the bad behaviors that lead to obesity, and cultivate diet habits conducive to weight loss.

## RESULTS

The weight, BMI, upper arm skin fold thickness, subscapular skin fold thickness, and abdominal skin fold thickness of obese adolescents were significantly higher than those of the control group. After aerobic exercise intervention, obese adolescents' body weight, BMI, upper arm skinfold thickness, under the shoulder blade angle skinfold, abdominal skinfold then dry preliminary decreased significantly, and compared with healthy controls, there was no statistical difference [Table 2].

The systolic blood pressure of obese adolescents was statistically significantly higher than that of the control group at quiet time ( $P < 0.01$ ). In addition, the pulse and diastolic blood pressure were not statistically significant ( $P > 0.05$ ) when compared to that of the control group. The systolic blood pressure

**Table 1: Basic information of test and control groups**

Group	n	Age	Weight	BMI (kg/m <sup>2</sup> )
Obesity group	52	13.42±1.18	76.08±11.90	29.96±3.16
Contrast group	52	13.67±1.37	59.23±6.26	23.74±2.13

BMI: Body mass index

**Table 2: Comparison of body shape indicators of obese adolescents before and after calisthenics intervention (X±standard deviation)**

Group	Weight	BMI (kg/m <sup>2</sup> )	Upper arm sebum	Subscapular horn sebum	Abdominal sebum
Before	61.21±7.87	23.86±2.77	19.01±3.10	22.99±4.53	25.07±0.29
After	76.0±11.90	29.9±3.16	24.74±5.54	31.32±5.89	34.13±5.92
Comparison	59.23±6.26	23.74±2.13	18.30±5.26	23.26±5.21	26.50±3.89

BMI: Body mass index

**Table 3: Comparison of physiological indexes of obese adolescents before and after calisthenics intervention ( $\bar{X} \pm$  standard deviation)**

Group	Systolic pressure	Diastolic pressure	Sphygmic
Before	97.03±12.37	68.31±17.37	74.32±11.10
After	110.75±24.95	69.26±22.64	77.98±11.39
Comparison	96.37±18.66	68.75±16.92	76.74±11.25

of obese adolescents was statistically significantly lower than after the aerobic exercise intervention when compared to that before the aerobic exercise intervention ( $P < 0.01$ ), and the difference was not statistically significant when compared with the healthy control group [Table 3].

## CONCLUSIONS

A large number of studies have shown that calisthenics can improve learning and memory ability and have a positive effect on the improvement of cognitive function. Animal hair now, long jump aerobics can enhance effect on hippocampus group, improve brain woven antioxidant capacity, and through the plasma and different brain regions of opioid peptide transmitters level influence to strengthen to improve cognitive function; exercise training can promote the recovery of nerve function by upregulating the expression of growth-related proteins.<sup>[4]</sup> Moderate-intensity exercise has been found to increase the number of dendritic spines of pyramidal cells in the hippocampal CA3 region of rat brain, thus improving the cognitive ability by increasing the connections between nerve cells. This study found that aerobics after comprehensive intervention, obese adolescents work speed and accuracy is a significant rise in aerobic exercise before the comprehensive intervention, show that aerobic exercise to improve the obese adolescents attention focus ability, improved the obese adolescents learning dysmnesia, improve the ability of learning and memory.<sup>[5]</sup> This may be because long-term aerobic exercise has been found to increase the brain-derived neurotropic factor

and its receptor in the brain of expression and use, and under the action of a large number of incoming and outgoing information, changes of shape and structure of central neurons/ In addition, they have long oxygen exercise to lower body fat obese adolescents, visceral fat reduction, higher volume, maximum aerobic exercise ability to strengthen, improve cardiopulmonary function, make the obese adolescents to improve cerebral blood oxygen saturation, blood circulation improvement, neurons receive adequate nutrition and oxygen supply, then improve the cognitive ability in obese adolescents.<sup>[6]</sup>

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## Conflicts of interest

There are no conflicts of interest.

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