Research and Countermeasures on the Influence of Air Pollution on Human Health and Fitness

Yongjun Zhao, Teng Ma
Beijing Institute of Fashion Technology, Beijing 100029, China
*a jcbmt@bift.edu.cn

Abstract. Air pollution has a significant impact on human health and fitness; long-term air pollution will cause human physical fitness to be declined. In order to alleviate the impact of air pollution on human health and fitness, this paper analyzes the sources of air pollution, different air pollution extents have gradient effect on the human body, thereby affecting the body's physical performance indicators. This paper investigates and studies the impact of air pollution on human health and fitness through the survey of students in a school, and provides countermeasures.

Keywords: air pollution, health, fitness.

1. Introduction
Air pollution is a public health and environmental issue that affects human health. In recent years, it has received more and more attention and research from domestic scholars. The main pollutants in the air are carbon monoxide, nitrogen oxide, ozone, sulfur dioxide and inhalable particulate matter. Air pollutants can cause short-term acute and long-term chronic health hazards; it will also have a long-term and profound impact on the human body. This paper synthesizes research data on air pollution at home and abroad, explores the impact of air pollution on human functions, in order to enhance the understanding and prevention and control of air pollution.

2. Air Pollution and Health
Research at home and abroad can determine that air pollution is closely related to the increased incidence and mortality of heart and lung diseases, it mainly includes inflammation of the lungs and the whole body, atherosclerosis, vascular dysfunction and coronary heart disease. Air pollution caused by car exhaust can cause complex reactions in the lungs. Contaminated air enters the blood from the lungs, causing inflammation throughout the body, thus causing the disease network of the cardiovascular system. In the air pollution environment, the human body is in a long-term mild hypoxia state, this may also be the basis of heart and lung diseases. O3 is a strong oxidant, which has a strong stimulating effect on the mucous membrane of the respiratory tract and can also cause nerve poisoning. SO2 and NO can form acid on the respiratory tract mucosa after entering the respiratory tract, inducing or worsening asthma. NO is also a normal biologically active substance in the body. Low concentrations of NO can strengthen myocardial contractility; the high concentration of NO actually reduces the contractility of the myocardium. There is still a lack of in-depth research on the health hazards of air pollutant NO.
The health hazard of PM is related to its particle aerodynamic diameter. Due to the aerodynamic characteristics, PM10 is mainly deposited in the upper respiratory tract, while PM2.5 is more likely to enter the alveoli and diffuse. As the volume of PM decreases, the amount deposited in the lung increases, and there is no gender difference. PM can cause acute and chronic harm from adsorbed components; the mechanisms that induce inflammation of the trachea are free radicals and oxidative damage, activation of transcription factors and inflammation-related factors, destruction of cellular calcium homeostasis, fibrosis and mutagenic effects. Both PM2.5 and PM10 can increase the risk of myocardial ischemic attack by 3 times. The toxicity of PM to the cardiovascular system is mainly manifested in the increase of white blood cells and endothelial adhesion molecules in the blood, enhance blood coagulation activity, and can change the normal electrophysiology of the heart. The heart function changes after PM exposure, while PM can also change the normal activity of nerve conduction pathways; it also has a bad effect on muscle microcirculation.

3. The Impact of Air Pollution on Fitness
Current studies believe that the decline in exercise capacity is related to air pollution. Through the research and analysis of the exercise function, air pollution has a greater impact on the aerobic exercise capacity of adults; it has little effect on anaerobic exercise capacity. Studies have found that short-term acute CO exposure reduces the maximum aerobic exercise capacity of young people, after breathing mixed CO air, the blood lactic acid and pyruvate levels are no different from breathing normal air. There was no difference in the ratio of lactate to pyruvate, which represents the level of anaerobic metabolism, after exercise, and there was no difference in maximum heart rate and blood pressure.

Some scholars have concluded that the air pollutants O3, SO2, CO and mainly affect the nerve and cardiopulmonary function by acting on the respiratory system, thereby affecting exercise capacity. Under air pollution, the mechanism by which exercise aggravates myocardial ischemia is not fully understood. One possibility is to reduce the supply of oxygen to the heart muscle, which may be related to the contraction of blood vessels and temporary thrombosis; the other possibility is to reduce the oxygen transport capacity, this is associated with an increase in CoHb and an increase in oxygen demand, changes in the energy metabolism of the myocardium. The impact of air pollution on fitness is shown in Fig.1.

![Fig. 1 The impact of air pollution on fitness](image-url)
4. Empirical Research Analysis

4.1. Research object

This paper studies the impact of air pollution on human health and physical fitness, the research objects are 520 students from a university. The sports training programs they often participate in are basketball, track and field, swimming, table tennis, etc. The training contents are contents outdoors, and the gender and age distribution of the test subjects is shown in Table 1.

Table 1. The gender and age distribution of the research subjects

| age  | the number of boy students | the proportion of boy students | the number of girl students | the proportion of girl students |
|------|---------------------------|-------------------------------|---------------------------|-------------------------------|
| 15-20| 78                        | 14.34%                        | 94                        | 12.87%                        |
| 20-22| 138                       | 54.54%                        | 100                       | 13.43%                        |
| 22-25| 84                        | 17.34%                        | 26                        | 8.34%                         |
| total| 300                       | 68.54%                        | 220                       | 31.23%                        |

Perform statistical analysis on the above-mentioned research objects, analyze the impact of air pollution on the physical fitness of students of different ages, and obtain the proportion distribution of test objects in different age ranges as shown in Fig.2.

![Fig. 2 proportion distribution of research objects in different age](image)

4.2. Research method

In the analysis and modeling of the influence of air pollution on the physical fitness of the research objects, the cardiopulmonary function measurement method is used to analyze the influence of air pollution on the maximum oxygen uptake VO2, myocardial enzyme spectrum and heart rate of the body function index, by combining the other technology, air pollution index is measured, outdoor high-intensity sports exercise are conducted under different air pollution levels, the significant level of physical fitness changes of the research objects is $P > 0.05$, the probability of cardiopulmonary disease $\geq 1.85$ mm, use SPSS 13.0 software carry out quantitative test and analysis of air pollution on the physical changes of the research objects, use the imaging system to observe the physical strength value.
of the research object during the training period under different pollution levels, and verify the empirical data, use the measurement method of myocardial function, obtain the distribution of body function metabolism of the research objects, as shown in Fig.2.

(a) Under mild air pollution   (b) Under severe air pollution

Fig. 3 The distribution of body function metabolism of the research objects

5. Empirical Result Analysis and Countermeasures

According to the test results given in Table 1, the descriptive statistical analysis is conducted; the analysis results of the fitness test indicators of different research objects are shown in Fig.4. The analysis of Fig.4 shows that under air pollution, the research subjects exercise and cause physical fatigue, the hybridization of acrylamide appears in the physical function indicators, which leads to a sudden decrease in the physical fitness of the research object, and insufficient maximum oxygen uptake output causes poor exercise effects. Through air pollution control, the physical fitness of the research object is retested to verify the above accuracy of research results.

Fig. 4 Analysis of physical fitness test indicators of air pollution on research objects

This paper analyzes the negative impact of air pollution on the physical fitness of the research subjects during exercise, and conducts a statistical regression analysis on the test group; air pollution has a significant relationship with the decline of athletes’ physical fitness, it is necessary to formulate a scientific training plan to reduce air pollution damage to the health and fitness of research objects.
6. Conclusion
In summary, air pollutants mainly affect human health and fitness by the respiratory system, affecting nerves and cardiopulmonary functions. Therefore, as air pollution becomes more and more serious, the most urgent problem at present is to monitor the air environment, formulate quality standards for the atmospheric environment, I believe that with the continuous improvement of people's awareness of environmental protection and the further control of environmental pollution, the impact of air pollution on people's body will become less and less.

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