Review Article

Influence of Urban Atmospheric Ecological Environment on the Development of Outdoor Sports

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In recent years, the process of urbanization in China has developed rapidly. However, many problems have also appeared, such as a rapid population increase, resource shortage, and deterioration of the ecological environment. The deterioration of the ecological environment has led to increased air pollution and noise pollution, threatening human health, and hindering outdoor sports. This paper takes a certain city outdoor sports venue as the research object and studies the influence of the urban atmospheric ecological environment on the development of outdoor sports through the method of questionnaire survey and mathematical statistics. The results show that the city’s air quality index in 2019 was “excellent” and “good” for a total of 240 days, the greening rate reached 35%, the noise decibels were between 38 dB and 67 dB, and the ecological environment was good. According to statistics, 5.8% of students, 24.23% of middle-aged people, and 37.24% of elderly people in the city who engaged in outdoor sports often experience physical discomfort. After launching outdoor sports in this atmospheric ecological environment, 49.84% of students, 44.59% of office workers, and 39.65% of elderly people feel that their body and mind have improved. A good urban ecological environment can improve the physical and mental health of outdoor sports personnel. Through outdoor sports, the physical and mental health of all sports groups in the ecological environment has been improved. According to the location of this study, the subjects generally said that in the good atmospheric ecological environment of the city, outdoor sports improved physical and mental health.

1. Introduction

Air pollution refers to the atmospheric state where the content of some substances in the air environment reaches a harmful level, which leads to ecological damage and affects people’s health and safety. Air environmental pollution brings serious harm to the normal activities and life of human beings [1]. The human body is exposed to the polluted air environment to inhale pollutants and cause diseases. As the concentration of pollutants in the air environment rises to a certain level, it will directly affect the earth’s water resources and food. The human body inhales the heavy metal diseases in the polluted air, which brings serious harm to the human life and health [2]. With people’s enthusiasm for outdoor sports, outdoor sports in an air-polluted environment will inevitably inhale more pollutants under accelerated breathing, causing pollutants to enter the human body with respiration and be transported with the blood, leading to respiratory diseases, lung cancer, capillary diseases, and other chronic diseases [3].

According to investigations and studies, the content of air pollution particles such as aromatic compounds in each cubic meter of air rises by 10 micrograms, and the long-term lung cancer mortality rate rises by 8%. Long-term outdoor sports in the polluted air will dilute the air by lung function. Diffusion and purification ability are weakened, affecting health [4]. Therefore, studying the impact of air pollution on outdoor sports people and formulating corresponding defensive measures are of great significance to ensure physical health and safety and reduce the harm of air pollution to outdoor sportsmen [5].
Air is the distributed atmosphere on the surface of the earth. Air provides people with a source of oxygen to breathe. It is also an important component of the earth’s environment. Air is the foundation for all living substances to survive [6, 7]. However, with the continuous advancement of the current industrial process, the development of the chemical industry and the increase in dust storms and automobile exhaust emissions have caused serious damage to the air environment and further deterioration of air quality. Air pollution has seriously affected the safety of human life and brought serious harm to human health and dietary health. Smoke and fine particles in the air can cause bronchitis, lung cancer, and various chronic diseases [8]. The polluted air environment can easily lead to the destruction of the ozone layer, resulting in acid rain and PM2.5 substances, which will damage the earth’s water sources and ecological substances, thereby seriously affecting the safety of the earth’s survival. Air environmental pollution refers to the factors that come from man-made and natural factors. With the increase in the quantity, concentration, and retention time of pollutants discharged into the air, the dilution, diffusion, and purification ability of the atmosphere in the air environment is weakened, which leads to the deterioration of air quality [9, 10]. The substances in the air environment exceed the indicators that human health can withstand.

Pollutants in the air environment are mainly composed of aerosol state pollutants, particulate matter, sulfur-containing compounds, nitrogen-containing compounds, and carbon compounds [11, 12]. Depending on the source of emissions, pollutants will cause primary pollution and secondary pollution, which will undergo chemical reactions or photochemical reactions that form compounds such as H2S, CO2, CO, and HF, and the oxygen compounds in the atmosphere will also form carbon monoxide, carbon dioxide, sulfur dioxide, and organic compounds [13]. These compounds are suspended in liquid droplets or solid particles through hydration. The increase in total suspended particulate (TSP) matter and the increase in inhalable particles. The hydrocarbons, oxygen-containing organic compounds, sulfur oxides, and lead compounds in the air have become the main components of air pollution. According to the nature of the pollution, the air pollutants are divided into two types: oxidizing and reducing [14].

The pollution sources of the air environment are mainly divided into two aspects: human and natural factors. The composition of air pollution sources includes human factors and natural factors. Natural factors include forest fires, volcanoes, sand, dust, etc., which will produce CO, CO2, SO2, and NO2. HC and other combustion materials, natural wind, and sand will cause dust, smoke droplets, fog, dust, floating dust, suspended matter, and other pollutants to float in the air [15, 16]. The pollution of the air environment caused by human factors includes fuel combustion, emissions from industrial production, emissions from transportation, emissions from agricultural activities, etc. Among them, the pollution caused by fuel combustion is mainly due to industrial production. The burning of coal in industrial production will produce carbon monoxide, carbon dioxide, sulfur dioxide, and other substances, which can cause great pollution to natural air, water bodies, and soil [17].

Emissions during transportation mainly come from the exhaust emissions of automobiles and the emissions of ships and airplanes. With the increase of automobiles, automobile exhaust emissions seriously pollute the environment. Nitrogen oxides, hydrocarbons, and oxygen-containing organic compounds in the exhaust are inhaled by the human body, which can cause cerebral infarctions, tuberculosis, and other respiratory diseases [18]. Therefore, it is necessary to control automobile exhaust emissions and achieve energy saving and emission reduction. Agricultural emissions mainly refer to air pollution caused by burning straws, pesticides and dust, and other particulate matter, which mainly produce carbon, oxygen compounds, and hydrogen-combined hydrocarbons, and other pollutants and produce colorless and pungent odor gases such as sulfur dioxide [19]. These pollutants can damage the lungs of the human body and cause harm to outdoor sports people. This paper conducts a questionnaire survey on several outdoor sports venues in a city to understand the impact of the urban atmospheric ecological environment on the development of outdoor sports.

2. Materials and Methods

2.1. Research Object. The selected locations of the article research are outdoor sports venues in three squares and four parks in a certain city and investigate and study the crowds who carry out outdoor sports in these places. 400 men and 400 women were selected for the study, a total of 800 persons, aged 20–75 years. The study objects included school students, individuals, and retired persons [20].

2.2. Research Method

2.2.1. Questionnaire Survey. We collect relevant questionnaire survey data and design survey questionnaires according to needs. A questionnaire survey was conducted among 800 citizens who are engaged in outdoor sports activities in various ecological environments of the city.

1. Test the Validity and Reliability of the Questionnaire. We invite an expert team including 6 professors and 10 associate professors to review the content of the questionnaire item by item and check whether the content of the questionnaire fits the subject and whether the survey information provided is accurate. The questionnaire proposes amendments, which will be reviewed by the expert team after the amendments and will be issued after passing the questionnaire survey. Retesting the reliability of the questionnaire: the method used in the reliability test of the questionnaire is the retest method. In August 2019, 800 questionnaires were distributed at 7 locations among the research subjects. The distribution method was random. After collecting the questionnaires, the questions were counted, and related questions were modified and debugged. After one month, the questionnaires were redistributed randomly, measured again, and finally determined.
(2) Questionnaire Indicators. The indicators set by the survey questionnaire include outdoor sports items, outdoor sports methods, outdoor sports goals, outdoor sports frequency, outdoor sports duration, time distribution, etc.

(3) Distributed Questionnaires and Return Questionnaires. The article survey questionnaire was distributed using random sampling method. 800 outdoor sports athletes were randomly selected from the research target sites to conduct a survey. A total of 800 questionnaires were distributed in this survey. The distribution and collection results are shown in Table 1.

A total of 800 questionnaires were distributed, and 761 questionnaires were returned. All of the questionnaires were valid. The average recovery rate was 95%. 400 male and 400 female subjects were randomly selected, aged 20–75 years, with an average age of 48 years.

(4) Questionnaire Distribution Quality and Recycling Quality. Because the questionnaire survey method has a strong randomness, it can guarantee that the respondents will not have specificity. Before randomly distributing the questionnaires, the staff who distributed the questionnaires were trained on the content of the questionnaire to ensure the professionalism of the staff.

2.2.2. Mathematical Statistics. We organized the questionnaires collected by the questionnaire survey method, used the SPSS26.0 to count and analyze the data, and obtained the required data. In order to study the impact of the city’s urban ecological environment on outdoor sports, mathematical statistics combined with RS and GIS technologies were used to calculate the city’s ecological environment indicators. Using the Landsat TM’s image data in 2019, the bands are combined into 4, 3, and 2, using the polynomial model geometric error correction. The urban ecological environment data comes from the provincial water resources announcement and the municipal environmental statistics annual report.

(1) Vegetation Cover Index. The various types of land in the city account for the proportion of the total urban land area. The types of land include construction land, forest land, fields, grassland, and unused land. The vegetation coverage index formula is as follows:

\[
X = \frac{\text{Aveg} \times (0.38 \times F + 0.34 \times G + 0.19 \times P + 0.07 \times B + 0.02 \times M)}{Q},
\]

where \(X\) represents the vegetation coverage index; \(F\) and \(G\) represent forest land and grassland area, respectively; \(P\) and \(B\) represent field area and construction land, respectively; \(M\) represents unused land; \(Q\) represents the total area of the urban area; and Aveg represents the normalization coefficient of \(X\), which is set as 588.37 in this study.

The urban ecological environment quality index can quantitatively express the city’s ecological environment quality. The following formula shows the urban ecological environment quality index expression:

\[
Y_Ai = \frac{\sum_{i=1}^{n} HJ_i \times D_i}{Q},
\]

where \(n\) represents the number of land types, \(Y_A\) and \(D_o\) respectively, represent the ecological environment quality index and the weight of the \(i\)-th land ecological environment index; and \(HJ_i\) represents the area of the \(i\)-th land type in the urban area during the \(t\) study period.

(2) Measurement of Urban Air Pollution Degree and Urban Noise. The elements that cause air pollution and noise pollution in the urban ecological environment are mainly automobile exhaust emissions, factory emissions, traffic noise, industrial imaging, and life noise.

(3) Urban Air Pollution Detection. The particle detector produced in the United Kingdom: DustMate smoke detector is used to detect the air pollution in 7 areas of the research object (3 squares and 4 public parks), and the accuracy of the instrument is 0.01 \(\mu g \text{ m}^{-3}\).

(4) Urban Noise Measurement. AWA6218 noise monitor was used to monitor the noise pollution in 7 areas (3 squares and 4 parks) of the research object, and the accuracy of the instrument was 0.01 dB(A).

3. Results

Using the article method to count the air quality index of the city, there are 6 levels from “excellent” to “severe pollution,” corresponding to each color and level. When the weather forecast is broadcast, the impact of different air quality indexes on human health is measured. Table 2 shows the air quality index for the whole year of 2019. The number of days with an air quality index of “excellent” in the whole year is 114 days, accounting for 31.23% of the total pollution in the year. This air quality index is the most suitable for outdoor sports. The number of days when the air quality index is “good” is 126 days, accounting for 34.52% of the total annual pollution. This air quality index is more suitable for outdoor sports. When the air quality index is at the “pollution” level, it is no longer suitable for children, the elderly, and people with special diseases to carry out outdoor sports. It can be seen from Table 2 that the city did not experience “severe pollution” and “severe pollution” in mid-2019. The number of days with “light pollution” and “moderate pollution” was 98 days and 22 days, respectively, accounting for 26.84% and
6.02% of the total pollution in the year. On the whole, the number of days suitable for outdoor sports in the city is about 240 days. After analysis, it can be seen that the urban ecological environment has a greater impact on the development of outdoor sports, and only a good air quality index can be beneficial to the development of outdoor sports.

The city has a large area of forest resources. According to statistics, the city’s urban greening rate has reached 35%. The greening of parks and squares is the point, the street greening is the line, and the woodland greening is the surface, making the entire urban ecological environment present a point-to-face greening scale. Over the years, the city has always implemented the sustainable development route, increased ecological environmental protection, strengthened pollution control, increased vegetation area, advocated outdoor sports, and encouraged the public to actively participate in it. The level of vegetation and greening in public places such as parks and squares has improved, and more and more citizens are actively participating in outdoor sports. Therefore, it can be seen that the greening level of the urban ecological environment will also affect the development of outdoor sports. A good urban ecological environment can attract more people to participate in outdoor sports.

As a part of the urban ecological environment, noise pollution also has a huge impact on the urban ecological environment. Figure 1 shows the average value of traffic noise in 2019.

Figure 1 shows the annual average value of traffic noise in the seven research object places monitored by this method. Three squares are open spaces, and the traffic noise is relatively close to the road, so the traffic noise decibels are between 54 and 67 dB. The four parks are semienclosed spaces and are far away from the road, so the noise decibels are low, and the noise decibels are between 38 and 43 dB. According to the noise evaluation standard, they are all Grade I, which is at a relatively good level, indicating that the seven places studied in the article have good ecological environments and are suitable for outdoor sports.

Based on the abovementioned air quality status, vegetation coverage index, and average traffic noise results, the ecological environment changes in the city are evaluated. The evaluation results are presented in the form of scores. The evaluation standards are as follows: 0–60 points (the ecological environment level is poor), 60–75 points (the ecological environment level is normal), 75–85 points (the ecological environment level is good), and 85–100 points (eco-environmental grade is excellent). Table 3 shows the assessment results of changes in the city’s ecological environment.

The urban ecological environment directly affects the physical health of outdoor sports personnel. The article method is used to count the physical conditions of different age groups after outdoor sports in the urban ecological environment. It can be seen from the results that after the article method statistics, outdoor athletes of different age groups reflect different physical conditions when they exercise outdoors in the ecological environment (Figure 2). The probability of the student group feeling regular physical discomfort is very low, 5.8% of students have physical discomfort, and 37.32% of students have no physical discomfort at all. 24.23% of middle-aged (24–55 years old) outdoor sports personnel often have physical discomfort.
discomfort, and 13.26% have no physical discomfort at all. 37.24% of the elderly are often unwell, and only 4.69% of the elderly have no physical discomfort at all. Generally speaking, the elderly people carry out outdoor sports in the city’s ecological environment, and their health is affected by environmental pollution, traffic noise, and other factors. However, students and middle-aged people have higher physical fitness such as immunity and are less affected by the ecological environment, so the body does not have much impact. It can be seen that the urban ecological environment has a great influence on the development of outdoor sports, and outdoor athletes with poor physical fitness are more seriously affected by the urban ecological environment.

We use the article method to count the physical and mental perception of outdoor athletes after exercising in the ecological environment for a period of time. It can be seen from the statistical results (Figure 3) that 49.84% of students said that physical and mental health of outdoor sports activities in the city’s ecological environment have changed, and only 0.86% of students said that no physical and psychological changes have occurred after they carried out outdoor sports activities in the city’s ecological environment. 44.59% of middle-aged people said that carrying out outdoor sports activities in the city’s ecological environment can change their physical and mental health, and 12.34% of middle-aged people said that there has been no change in their physical and mental health. 39.65% of the elderly said that physical and mental health of outdoor sports activities in the city’s ecological environment has been improved, and 10.25% of the elderly believe that no changes have occurred. Generally speaking, the physical and mental health of all sports groups in the ecological environment by carrying out outdoor sports has improved.

According to the statistics of the article, the research subjects generally stated that in the city’s atmospheric ecological environment, outdoor sports have generally improved physical and mental health. It shows that the urban ecological environment has an important influence on the development of outdoor sports.

4. Conclusions

(1) In this paper, questionnaire survey and mathematical statistics are used to integrate the two methods. Taking three squares and four park outdoor sports venues in a city as the research sites, 400 men and 400 women, a total of 800 people, aged 20–75 years, were selected. This paper analyzes the impact of outdoor sports development on urban atmospheric ecological environment through questionnaire survey.

(2) The results show that the average value of noise and other factors affects the development of outdoor sports to varying degrees. Urban air quality has a physiological impact on outdoor sports people. A good urban ecological environment can bring good development to outdoor sports.

(3) The results of this study show that the number of days of air reaching the standard in the city is 240 days, accounting for 65.8% of the whole year; According to the noise evaluation standard, the noise of the seven locations in this study is level I, which is at a good level. People of different ages have different physical perception characteristics of air quality. The elderly are more sensitive to outdoor urban environment. The higher the quality of urban environment, the more conducive to people’s health.

Data Availability

The figures and tables used to support the findings of this study are included in the article.
Conflicts of Interest

The authors declare that they have no conflicts of interest.

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