How Does Urban Park Affect People's Health? An Empirical Study Based on Xiaoyaojin Park in Hefei

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Abstract. As one of the important forms of urban space, urban parks not only provide green space, but also support a variety of outdoor recreation activities. They play an important role in the life of urban residents' sports, leisure and social interaction, and have great potential effect on promote people's physical and mental health. This study used a questionnaire survey method, SF-12 health questionnaire was used to quantify the physical and mental health of park users. Satisfaction questionnaire was used to evaluate park users' satisfaction with park characteristics. Multiple regression analysis was used to reveal the relationship between urban park and park users' physical and mental health score. The results show that there is a positive correlation between the time of using the park, the satisfaction with the overall environment of the park and their scores of physical and mental health. Park users’ satisfaction with the activity facilities of the park is positively correlated with their physical health score, and their satisfaction with the plant landscape of the park is positively correlated with their mental health score. The conclusion shows that urban parks have a positive impact on people's physical and mental health.

1. Introduction
As a public green space that urban residents use frequently, urban parks not only have an important impact on the built environment and ecological environment, but also have a potential impact on the physical and mental health of urban residents. With the deteriorating of urban living environment and the worrying of physical and mental health of urban residents, the potential recovery benefits of urban parks for people’ health have attracted more and more scholars' attention. A large number of studies have focused on the relationship and impact of city park environment and residents' health, and believe that the park environment has become an important place for people to relieve mental stress, eliminate fatigue, strengthen the body and promote social interaction [1]. Starting from early landscape therapy, rehabilitation gardens, etc., urban parks with green plant as the main body have a positive effect on people's physical and psychological health in many aspects [2-5]. To verify the health benefits of urban parks further, this study explored the specific effects of urban green space on the physical and mental health of park users by evaluating the physical and mental health of park users and the satisfaction of park users about the characteristics of the park. The results can provide reference for the theoretical study of urban green space health efficacy.
2. Object and Methods

2.1. Study site
The study site of this article is the Xiaoyaojin Park in the old town of Hefei. It is a beautiful park with a long history and culture with relatively complete facilities, which can meet the basic needs of park users. The park covers an area of 31.3hm², of which the water surface area is about 11hm². The layout of the park is fan-shaped, and it is divided into east and west part by the water system and roads. The East part is dominated by water bodies and activity lawns, and is mainly composed of youth activity areas and cultural activity areas. The West part adopts classical garden design style and has an elegant and refined spatial structure. The park has beautiful scenery, dense vegetation, high green coverage and high plant richness. There are more than 180 species of plants in the garden and 10257 different kinds of trees. Among them, there are many famous trees over 100 years old, such as Quercus acutissima, Platycladus orientalis, juniper, Ginkgo biloba and Pinus bungeana.

2.2. Study object
This study takes Xiaoyaojin Park as the study site, study objects are urban residents who use the park in different periods of time. A questionnaire survey was conducted between September and December 2019 by using a stratified sampling method, and all study participants completed the questionnaire on an informed and voluntary basis, as required by ethics. A total of 260 questionnaires were collected, and 206 questionnaires were obtained after exclusion of the population with chronic diseases. The efficiency of the questionnaire was 79.23%.

2.3. Study content and tools
The study content includes personal characteristic information of park users, their physical and mental health status and park satisfaction. Personal characteristic information was investigated by self-designed questionnaire, physical and mental health was assessed by SF-12, and park satisfaction was assessed by self-designed satisfaction questionnaire.

The personal characteristics of the subjects were obtained by self-designed questionnaires, including gender, age, height, weight, marital status, educational background, occupation and income level.

SF-12 scale was used to assess physical and mental health status. SF-12 is a simplified version of the universal and concise quality of life scale developed by the Boston Institute of Health Education [6]. The 12-item health-related quality of life scale assessed eight dimensions, general health, physical functioning, role-physical, bodily pain, vitality, social function, role-emotional, and mental health [7]. SF-12 scale has good reliability and validity, so it is often used as the first choice to evaluate the quality of life.

The satisfaction degree of parks was evaluated by self-designed satisfaction degree questionnaire. The questionnaire was made up of three self-rated satisfaction items: "are you satisfied with the overall environment of the park?", "are you satisfied with the plant landscape of the park?", "are you satisfied with the facilities of the park?". Items are assigned by a Likert scale, which ranges from dissatisfied (1) to very satisfied (5).

2.4. Analysis method and variable assignment
STATA 15.0 was used for descriptive statistics and correlation analysis. Physical and mental health of park users and park satisfaction were evaluated by mean standard deviation (Mean±SD). The scores of physical and mental health of park users were taken as the dependent variables, and the time spent in the park, the satisfaction of overall environment, plant landscape and activity facilities were taken as the independent variables for the regression analysis, gender, age, height, weight, marital status, occupation type and income level were included as control variables. The methods for assigning each variable are shown in Table 1.
Table 1. Variable assignment description

| Variable                        | Code | Assignment Description                      |
|---------------------------------|------|---------------------------------------------|
| Gender                          | X1   | 0=Male, 1=Female                            |
| Age (year)                      | X2   | Quantitative Data                           |
| Height (cm)                     | X3   | Quantitative Data                           |
| Weight (kg)                     | X4   | Quantitative Data                           |
| Marital Status                  | X5   | 1=Unmarried, 2=married, 3=Divorced, 4=Widowed|
| Education Level                 | X6   | 1=Primary school, 2=junior high school, 3=high school, |
| Vocation Type                   | X7   | 1=student, 2=Office work, 3=Physical work, 4=Retired |
| Income (RMB)                    | X8   | 1<1550, 2=1550–3500, 3=3500–5000, 4=5000–8000, 5>8000 |
| The satisfaction of the overall environment | X9   | 1=Low, 2=Relatively Low, 3=Middle, 4= Relatively High, 5=High |
| The satisfaction of plant landscape | X10  | 1=Low, 2=Relatively Low, 3=Middle, 4= Relatively High, 5=High |
| The satisfaction of activity facilities | X11  | 1=Low, 2=Relatively Low, 3=Middle, 4= Relatively High, 5=High |
| Time in the park (min)          | X12  | 1<30, 2=31–60, 3=60–120, 4=120–180, 5>180   |
| Physical Health                 | Y1   | Quantitative Data                           |
| Mental Health                   | Y2   | Quantitative Data                           |

3. Results

3.1. General information of respondents
206 park users were included in this study, including 67 males (32.53%) and 139 females (67.48%). In the group of marital status, there are 117 unmarried, 56 married, 2 divorced and 31 widowed. In the education level group, there are 2 primary schools, 19 junior high schools, 35 senior high schools, 81 undergraduates and 69 postgraduates. In the occupational group, there are 40 students, 102 office worker, 54 Physical workers and 10 retirees. In the income level group, there are 75 people with income less than 1550 yuan, 57 people with income between 1550-3500 yuan, 47 people with income between 3500-5000 yuan, 19 people with income between 5000-8000 yuan, and 8 people with income higher than 8000 yuan. See Table 2 for details.

3.2. Physical and mental health scores
Descriptive statistical analysis of the physical and mental health status of park users from the level of social demographic information is shown in Table 2. In terms of physical health, the overall score of 206 park users was (50.78±6.53). There were significant differences in scores of physical health among different marriage status ($P < 0.05$), education type ($P < 0.01$) and occupation type ($P < 0.01$). On the mental health level, the overall score of 206 park users was (48.61±8.21). There were significant differences in scores of mental health among different marital status ($P <0.01$), educational level ($P < 0.001$), occupation type ($P < 0.05$) and income level ($P < 0.01$).

3.3. Park satisfaction evaluation score
The overall environmental satisfaction evaluation score of 206 park users was (3.57±0.61) points, the park plant landscape satisfaction evaluation score was (3.64±0.63) points, and the park activity facility satisfaction evaluation score was (3.46±0.69) points. On the whole, park users have the lowest satisfaction with the park's activity facilities of the park, the middle satisfaction with the overall environment of the park and the highest satisfaction with plant landscape of the park.
Table 2. General information and health score of the respondents

| Variable          | Sort            | Number | Ratio(%) | Physical Health (x±s) | Mental Health (x±s) |
|-------------------|-----------------|--------|----------|-----------------------|---------------------|
| Total             |                 | 206    | 100      | 50.78±6.53            | 48.61±8.21          |
| Gender            | Male            | 67     | 32.53    | 50.92±6.62            | 49.92±7.29          |
|                   | Female          | 139    | 67.48    | 51.15±6.17            | 47.98±8.57          |
|                   |                 |        |          | F                     | 0.19                |
|                   |                 |        |          | P                     | 0.662               |
| Marital Status    | Unmarried       | 117    | 56.80    | 53.47±6.28            | 54.17±9.37          |
|                   | Married         | 56     | 27.81    | 56.71±6.40            | 58.64±6.54          |
|                   | Divorced        | 2      | 0.97     | 48.52±7.22            | 52.61±7.35          |
|                   | Widowed         | 31     | 15.05    | 50.31±7.26            | 47.93±5.82          |
|                   |                 |        |          | F                     | 3.97                |
|                   |                 |        |          | P                     | <0.05               |
| Education Level   | Primary school  | 2      | 0.97     | 55.34±6.14            | 45.44±8.08          |
|                   | Junior high school | 19     | 9.22    | 51.13±5.20            | 49.63±6.49          |
|                   | High school     | 35     | 1699    | 49.80±6.60            | 51.21±7.62          |
|                   | Undergraduate   | 81     | 39.32    | 53.58±7.16            | 47.60±9.13          |
|                   | Postgraduate    | 69     | 33.50    | 56.86±5.89            | 54.79±7.79          |
|                   |                 |        |          | F                     | 4.75                |
|                   |                 |        |          | P                     | <0.01               |
| Vocation Type     | Student         | 40     | 19.42    | 49.15±6.05            | 49.00±7.21          |
|                   | Office work     | 102    | 49.51    | 52.01±6.37            | 44.61±7.81          |
|                   | Physical work   | 54     | 26.21    | 50.51±5.85            | 51.40±7.76          |
|                   | Retired         | 10     | 54.85    | 46.17±5.32            | 46.85±6.56          |
|                   |                 |        |          | F                     | 3.89                |
|                   |                 |        |          | P                     | <0.01               |
| Income (RMB)      | <1550           | 75     | 36.41    | 52.05±6.55            | 52.74±8.02          |
|                   | =1550–3500      | 57     | 27.67    | 50.21±7.54            | 47.08±7.91          |
|                   | =3500–5000      | 47     | 22.82    | 49.83±5.15            | 48.10±9.27          |
|                   | =5000–8000      | 19     | 9.22     | 49.45±6.70            | 51.26±8.26          |
|                   | >8000           | 8      | 3.88     | 53.52±4.24            | 56.80±5.37          |
|                   |                 |        |          | F                     | 1.31                |
|                   |                 |        |          | P                     | 0.267               |

3.4. Regression analysis

Many documents prove that there is a linear relationship between urban park and the physical and mental health of the population. Urban parks have a positive effect on improving the physical and mental health of the population [8]. Therefore, this paper constructs a multiple linear regression model of park users' satisfaction and their physical and mental health. The regression coefficient results are shown in Table 3.

The regression analysis results of physical health showed that age, weight, occupation, time spent in the park each time, the satisfaction of overall environment and activity facility of the park can be included in the regression equation, in which work type is included as dummy variables. The equation formula is $\hat{Y}_1 = 43.61 - 0.374X_1 - 1.171X_2 + 2.143X_7 + 2.226X_8 + 0.445X_{11} + 3.319X_{12}$. The results show that the age and weight of park users are negatively correlated with their physical health scores. The older the age, the heavier of the weight, the worse of the user 's physical health. In the type of occupation, the physical health scores of physical work groups are higher than students, and there is no significant difference in the scores of the physical health status among the other categories. The time spent in the
park each time of park users have a positive correlation with their physical health status score, the longer of the time they spent, the better of the user's physical health status. The park users’ satisfaction of overall environment and plant landscape quality of the park are positively correlated with their physical health scores, the higher of the satisfaction they felt, the better of the user's physical health status.

The regression analysis results of mental health show that age, height, marital status, occupation, time spent in the park each time, the satisfaction of overall environment and activity facility of the park can be included in the regression equation, in which marital status and work type are included as dummy variables. The formula is \( \hat{Y} = 37.65 + 2.07X_1 + 1.27X_2 + 0.810X_3 + 2.051X_4 + 1.175X_5 + 1.991X_6 + 4.636X_7. \) The results show that the age and height of park users are positively correlated with mental health scores, the older of the age, the heavier of the weight, the better of the mental health status of the users. In the marital status, the scores of mental health of married users is higher than the unmarried, and there is no significant difference in the scores of mental health status among the other categories. In the type of occupation, the scores of mental health status of office work were lower than the student population, and there was no significant difference between the scores of mental health status among other categories. The time spent in the park each time of park users is positively correlated with their mental health score, the longer of the time they spent, the better of the user’s mental health status. The park users’ satisfaction of overall environment and plant landscape quality of the park are positively correlated with their mental health status scores, the higher of the satisfaction they felt, the better of the user's mental health.

**Table 3. Coefficient of regression model**

| Independent Variable                        | Physical Health | Mental Health |
|---------------------------------------------|-----------------|---------------|
|                                             | Coef.           | t             | 95% CI   | VIF | Coef.           | t             | 95% CI   | VIF |
| Age                                         | -0.374*         | -0.66         | -1.499~ -0.750 | 1.78 | 2.07***         | 2.76         | 0.594~ 3.550 | 1.83 |
| Height                                      | 0.947           | 1.36          | 0.427~ 2.321  | 1.46 | 1.27**          | 1.39         | 0.530~ 3.088 | 1.50 |
| Weight                                      | -1.171*         | -2.16         | -3.242~ -1.01  | 1.42 | -0.720         | -0.10        | -1.515~ 1.371  | 1.54 |
| Marrieda                                    | -1.892          | -1.68         | -4.119~ -0.334 | 1.30 | 0.810**        | 1.52         | 0.372~ 2.947  | 1.32 |
| Divorceda                                   | -2.811          | -0.61         | -11.956~ 6.334 | 1.08 | 5.397          | 0.90         | -6.473~ 10.267 | 1.08 |
| Widoweda                                    | -1.508          | -1.15         | -4.090~ 1.074  | 1.14 | -0.586        | -0.34        | -3.938~ 2.766  | 1.14 |
| Office workb                                | 1.337           | 0.76          | 1.123~ 6.765   | 2.66 | -2.031**       | -3.09        | -5.337~ 1.885  | 2.75 |
| Physical workb                              | 2.143**         | 1.28          | 1.162~ 5.447   | 2.82 | -2.212**       | -0.97        | -6.582~ 2.159  | 2.94 |
| Retireda                                    | -2.367          | -0.89         | -7.616~ 2.883  | 1.70 | -4.735         | -1.35        | -11.654~ 2.184  | 1.76 |
| The satisfaction of the overall environment  | 2.226**         | 2.39          | 0.387~ 4.066   | 1.68 | 1.175**        | 3.14         | 0.786~ 4.521  | 1.73 |
| The satisfaction of greening quality        | 0.928           | 1.22          | 0.573~ 2.429   | 1.67 | 1.991***       | 4.51         | 1.459~ 6.523  | 1.68 |
| The satisfaction of activity facilities      | 0.445**         | 3.49          | 0.578~ 4.117   | 1.42 | 1.091         | 1.10         | -0.867~ 3.048  | 1.44 |
| Time in the park                            | 3.319**         | 5.97          | 3.520~ 9.311   | 1.12 | 4.636***       | 4.89         | 4.201~ 10.101  | 1.21 |
| Constant                                    | 43.61           | 10.36         | 35.304~ 51.908 | 37.65 | 4.52         | 6.89         | 26.882~ 48.432 |      |

\( F \) \[3.56\] \[4.52\]

\( Prob > F \) \[0\] \[0\]

*\( P < 0.1, **P < 0.05, ***P < 0.01.  

aUnmarried as the control group.

bStudent as the control group.
4. Discussion and inspiration

This study explored the relationship between urban parks and the physical and mental health status of park users by investigating the physical and mental health status and park satisfaction of 206 urban residents, who using Xiaoyaojin Park in Hefei City. Multiple regression analysis showed that the each time of park users spent in the park and the satisfaction of overall environment quality of the park were positively correlated with their physical and mental health scores. The longer of the time they spent, the higher of the satisfaction with the overall environment quality of the park, and the better of the physical and mental health of the users, indicating that the better of the overall environment quality of the park, the greater of the benefit of promoting the physical and mental health of park users. the satisfaction of activity facilities quality of the park is positively correlated with their physical health scores, the higher of the satisfaction with park activity facilities quality, the better of the user's physical health status, indicating that the more quality of the activity facilities in the park, the greater of the benefit to the user's physiological health. The satisfaction of park users with park plant landscape quality is positively correlated with their mental health status scores, the higher of the satisfaction with park plant landscape, the better of the user's mental health status, indicating that the better of the plant landscape effect in the park, the greater the benefit to the user's mental health.

Based on the findings of this study, in the future, when designing urban parks, the construction of supporting interactive facilities in the park should be strengthened, focusing on the interactivity of the facilities. At the same time, multi-functional areas should be planned to meet different needs of people. Last, plant landscape should be designed reasonably, as to form the good visual sense.

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