

Healthy city planning: food, physical activity and social justice

The significance of urban historical parks to physical activity and public health: A case study in Beijing, China

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Abstract: Physical inactivity is a significant public health problem in cities. There is a growing consensus that physical activity results in a plenty of positive health outcomes. Therefore, finding a way to promote physical activity has the potential to improve public health as well as to control health care costs. More and more studies have proved that green infrastructure strongly affects physical activity carried out in our daily life. Urban parks eagerly visited by city dwellers are believed to promote walking and routine exercise, thus influencing population health. Based on the above assumptions, studies are conducted in three historical parks in Beijing (the Summer Palace, Beihai Park, Xiangshan Park) aiming at determining how well urban historical parks serve and influence public health for local residents, and developing recommendations for urban historical parks management and revitalization. This paper mainly researches 1) park users' physical activities, 2) community members that parks serve, 3) space size, facilities, historical and cultural atmosphere, attractiveness in parks as well as surrounding environment of the parks. Questionnaire are developed to collect park users' view of the role that they feel parks play in their physical activity. Semi-structured interview are used as complement for collecting information. We conclude that activity undertaken in the park is primarily associated with the land cover structure of the park and its location within the city. And physical activity is significant positive especially in mental health. These findings suggest that urban historical parks play a critical role in facilitating physical activity even beyond the neighborhood, and the needs also arise to conduct active maintenance and spread cultural knowledge to improve the benefits.

Keywords: Physical activity; Urban historical parks; Public health; Beijing

1. Introduction

Well-designed urban parks strongly that people are willing to visit affect the quality of human life in cities. Urban parks are good for physical health via promoting outdoor physical activity (Rydin et al., 2012). Many health problems can be prevented or alleviated through routine physical activity. It is widely acknowledged that the environment in which we live helps determine how physically active we are on a daily basis (Cohen et al., 2012). Some historical gardens in Beijing which serve as urban parks now play an important part in local people's life and urban sustainable development. Understanding the determinants of physical activity undertaken in urban historical parks and health benefits can promote the management and valorization of historical parks. Thus, those parks could attract the permanence of the resident population while keeping their historical and cultural asset/values intact (Nocca, 2017).

Existing studies have discussed relationships between park benefits, park characteristics, park use, physical activity levels and health (Bedimo-Rung et al., 2005, Agata et al., 2018, Abdullah, 2016, Bonnie et al., 2019). However, few studies have focused specifically on historical and cultural context which may affect physical activity and health. Besides, most researches on green open space use focus on North American, European, and Australian contexts (Özgüner, 2011, Sreetheran, 2017) so far.

Therefore, this research chooses historical gardens in Beijing including one cultural heritage which symbolize Chinese culture as object in order to find relationship between cultural context, physical activity and health. By focusing on Beijing, this research adds cases in Asian cities except for Hanoi (Thi-Thanh-Hien et al., 2019), Kuala Lumpur (Sreetheran, 2017) and so on.

We investigate three urban parks in Beijing which are also historical gardens in the context of the following characteristics: a) intensity and duration of activity of park users and frequency of park visits; b) plant, paths, facilities, attractiveness, cultural atmosphere in parks; c) physical and mental health condition of park users; and d) location of the parks within the urban structure. The goal of our research is to determine how urban historical parks promote physical activity for individuals and how well they serve local people in national and regional cultural context. This research serves in the pursuit of balancing people's needs and cultural landscape protection, and improves the management and preservation plan of urban historical parks. We hope that this research could develop recommendations on protection and valorization of urban historical parks adjusted to Asian cities and populations, thus achieving urban sustainable development.

2. Methodology

2.1 Study area

The research is conducted in Beijing (39° 56' N; 116° 20' E), capital of China. It is located in northwestern of the North China Plain, surrounded by Yanshan Mountain in the west, north, and northeast. It is a megacity with an area of 16410.54 sq. km. Beijing has a predominantly warm temperate continental monsoon climate. The annual frost-free period is about 186 days, the annual temperature of 10°C, and the average annual precipitation is 600 mm (Xie et al., 2015). Beijing has experienced rapid demographic urbanization and urban land expansion with the rapid economic growth during the past three decades and the urban area has increased from 801 to 2,452 km² during 1980–2010 (Wu et al., 2015), and its population increased from 8.72 million in 1978 to 19.62 million in 2010 (Beijing Municipal Statistics Bureau [BMSB] 2011). Beijing is a famous historical and cultural city in the world. There are more than 200 historical gardens with long history, high popularity and Chinese traditional garden design principle in Beijing, some of which serve as urban park and integrate into contemporary society.

2.2 Description of parks

We choose three famous historical gardens served as urban parks now differently located in Beijing. These parks are also different in size, landscape characteristics and surrounding areas which could lead to different physical activity features.

The following parks are analyzed: the Summer palace, Xiangshan Park and Beihai Park. We choose those parks for the following reasons.

As shown in Figure 1.a, the Summer Palace (290ha) (Figure 1.a) is located in north-western of central districts in Beijing, center area of Haidian district. It was built in 1750 in Qing dynasty. It was an imperial garden (temporary imperial palace) belonged to Qing imperial family. Since 1928, it has become a national park. In 1998, the Summer Palace was awarded World Cultural Heritage which meets the criteria (i) (ii) (iii). Surrounding the Summer Palace are Qinglongqiao subdistrict, Wanliu subdistrict and part of Sijiqing subdistrict which respectively had a density of 3572 inhabitants/km², 3695 inhabitants/km², 1790 inhabitants/km² in 2006. It also includes a research institution, three universities and several cultural relics.

As shown in Figure 1.b, Beihai Park (71ha) (Figure 1.b) is located in Beijing central district, northwest of the Forbidden City. It was also an imperial garden which dates back to the 13th century. Since 1925, it has become a national park. Surrounding Beihai Park are

As shown in Figure 1.c, Xiangshang Park (188ha) (Figure 1.c) is located in northwest of central districts in Beijing, north-western of Haidian district that urbanized after 2000. It dates back to Yuan dynasty. It was also an imperial garden (temporary imperial palace away from inner city). Since 1956, it has become a national park. Population densities around Xiangshan Park tend to be lower, with 428 inhabitants/km² in 2006. And there are two large botanical gardens around the park.



(a) the Summer Palace

(b) Beihai Park

(c) Xiangshan Park

Figure 1. Location of three historical parks

2.3 Data collection-questionnaire and semi-structured interview

We applied structured questionnaire and semi-structured interview (Bonnie, 2019), to survey people's activities undertaken in parks.

A quota sampling method was applied to collect opinions from questionnaires. Quota sampling follow three rules. First, we aimed mainly to local people who undertake physical activity regularly. Second, at each research park, gender and age ratio of respondents we sought is in accordance with demographic characteristics in Beijing. Third, we carried on the survey in each park two times a week, once in weekdays and once in weekend from morning to evening. All questionnaires were self-administered on paper during multiple site visits in May, 2019. The refusal rate was quasi-null.

The questionnaires survey was conducted on a face-to-face basis, in order to collect data more sociable and enlist respondent cooperation more effective (Sheskin, 1985). Most questionnaires were

filled inside the parks such as attractive sitting-out area and other open space, and the rest were filled at park entrances, It took about 6 minutes to complete a questionnaire. Each collected questionnaire was checked afterwards to ensure their completeness and accuracy.

The questionnaires administered to respondents include: i) respondents' characteristics (gender, age, education, occupation, yearly income, transportation mode, travel mode to access the park, time cost on the way to the park, habitual companion); ii) activities undertaken in the park (physical activity frequency, physical activity duration, physical activity types, place most frequently go to for physical activity); iii) respondents' health condition (physical health through the question 'How often do you have the following physical illness over the past month?', physical illnesses include fatigue, headache, neck pain, cold, insomnia, cardiovascular diseases, respiratory diseases, mental health through the questions 'How often do you feel happy over the past month?', 'How often do you feel down over the past month?'); iv) respondents' perception of the park through the question 'Which areas of the Park do you like taking physical activities?' and impacts (including attractiveness, strong historical and cultural atmosphere, good maintenance, enough public space size, many shades, quietness, good air quality, convenient service facilities) on choosing those areas, each of which are measured on a 7-point Likert scale ranging from 1=Strongly Disagree to 7=Strongly Agree. We suppose that respondents' perception of the park represent park's characteristic. At last, the respondents were asked to suggest how to improve the park to add comfort and convenience for use.

2.4. Statistical analysis

Multivariate linear regression analysis was used to analyze questionnaire data. We investigate the associations between characteristics of the park (e.g. attractiveness, strong historical and cultural atmosphere, good maintenance, enough public space size, many shades, quietness, good air quality, convenient service facilities) and frequency, duration, intensity of physical activity. Second, the associations between characteristics of the park, frequency, duration, intensity of physical activity and physical health, mental health were investigated. And it needs to be explained that physical intensity was calculated according to Compendium of Physical Activities which has been used as important criteria and reference basis for the determination of metabolic value and intensity division (Ainsworth et al., 2000). The results are presented as unstandardized coefficients (and SE) with 95% confidence intervals (CI). A p-value of .05 is considered to indicate statistical significance. R was used for all statistical analyses.

3 Results

3.1 Socio-demographics traits of visitors

During the survey, 72 visitors agreed to answer the questionnaire. Among them, 36 were male(50%) and 36 were female(50%). According to the 2010 Beijing Municipal Bureau of Statistics data, the percentage of men and women in Beijing is respectively 51.6% and 48.4%. About 51.4% of the respondents were over 60 years old; the youngest was 21 years old and oldest was 92. Majority of the respondents were retired (68.1%), a quarter of the respondents were full-time workers (20.8%), some were students (6.9%) and the rest were freelance or waiting for an employment (4.2%). Over half of the respondents' education level were associate or bachelor degree. Most respondents were low and

middle income groups. Majority of them received CNY0-50,000 (47.2%) or CNY50,000-100,000 (33.3%) per month.

3.2 Visit-related preferences

Most of the respondents visited the park by public transportation including bus and subway (79.2%). Almost half of the respondents cost 30 minutes to 1 hour to go to the park by public transportation (45.8%), and over one third of the respondents cost 1-2 hours (34.8%). The rest of the visitors cost less than 30 minutes (19.4%), and some of them go to the park on foot. For transportation, most of the respondents thought convenient.

Most respondents visited the park with family or friends because they enjoyed themselves in group. Over half of the respondents took physical activities in the park most frequently (65.3%), the second most of respondents took physical activities at home (18.1%), students usually took physical activities at school (8.3%), and the rest took physical activity in gymnasium (4.1%) or other place (4.2%).

According to semi-structured interview, some of retired respondents participate in scheduled events such as square dancing group, social dancing group and chorus group in certain area every day or on weekdays. And they feel very delighted spend time in the park.

3.3 Relationships between park characteristics, frequency, duration and intensify of PA

To investigate relationships between park characteristics, frequency, duration and intensify of PA (Physical Activity), we carried on a series of multivariate linear regression analyses. As shown in Table1, covariates (gender, age, education attainment, occupation, yearly income level) control for the result. In the multivariate regression analysis while controlling for the covariates, the findings indicate that PA frequency was positively associated with transportation convenience. Most of respondents visit the park by public transportation that they are content with which leads to higher frequency of PA. PA duration was positively associated with shades. PA intensify was positively associated with gender, education level, the place for physical activity, and historical and cultural atmosphere. Male take more intensive activities than female. Respondents with higher education level tend to take more intensive activities. The place for physical activity is also a factor influencing intensify of physical activities. Respondents who take physical activities in park most often take more intensive activities than others. Feeling strong historical and cultural atmosphere also causes more intensive activities in the park.

3.4 Relationships between park characteristics, frequency, duration and intensify of PA and health

Relationships between park characteristics, frequency, duration and intensify of PA and health were presented in Table 2. The analysis shows that physical health was positively related to habitual companion. Mental health was positively related to PA frequency, PA duration, gender, education level, transportation mode, historical and cultural atmosphere, and space size.

Table1 Summary of unstandardized multivariate regression coefficients for characteristics of three parks and levels of PA.

<i>Predictors</i>	PA frequency		PA duration		PA intensity	
	<i>Estimates</i>	<i>p</i>	<i>Estimates</i>	<i>p</i>	<i>Estimates</i>	<i>p</i>
(Intercept)	-3.73	0.216	4.15	0.35	1.28	0.756
male	0.5	0.05	0.11	0.757	-0.73	0.036
Age	0.2	0.156	-0.22	0.283	0.16	0.415
Education	0.02	0.919	-0.1	0.751	0.76	0.012
student	-2.24	0.177	-2.34	0.339	3.58	0.118
retired	0.77	0.345	-0.23	0.849	-0.96	0.391
full time	0.22	0.783	-0.7	0.553	-1.19	0.284
income	-0.25	0.368	0.47	0.255	-0.74	0.055
alone	-0.92	0.093	0.5	0.528	-0.21	0.774
convenience	1.07	0.003	-0.27	0.587	0.16	0.736
walk	0.42	0.746	1.03	0.586	2	0.259
bike	-0.9	0.479	-1.1	0.556	2.33	0.183
car	-0.49	0.636	-0.37	0.808	1.72	0.232
public transportation	-0.09	0.933	-1.04	0.52	2.43	0.108
time cost on the way	0.22	0.429	0.15	0.712	-0.07	0.843
park	1.01	0.253	-0.26	0.839	4.99	<0.001
school	1.75	0.158	1.44	0.426	1.14	0.499
home	-0.5	0.551	0.74	0.55	4.34	<0.001
gymnasium	-1.58	0.146	-0.14	0.931	4.69	0.003
attractive	0.14	0.442	-0.14	0.606	0.01	0.968
historical and cultural	-0.17	0.072	0.08	0.582	-0.34	0.009
maintenance	-0.08	0.657	0.08	0.771	-0.14	0.571
largeness	0.02	0.863	0.21	0.231	0.12	0.439
many shades	-0.16	0.083	-0.39	0.006	0.21	0.098
quietness	-0.11	0.294	0.04	0.804	-0.06	0.708
air quality	0	0.987	0.11	0.745	-0.17	0.587

convenient facilities	0.1	0.458	0.23	0.269	-0.12	0.523
Observations	72		72		72	
R ² / R ² adjusted	0.859 / 0.772		0.569 / 0.304		0.574 / 0.313	

Table 2 Summary of unstandardized multivariate regression coefficients for characteristics of three parks, levels of PA, and health.

<i>Predictors</i>	Physical health		Mental health	
	<i>Estimates</i>	<i>p</i>	<i>Estimates</i>	<i>p</i>
(Intercept)	18.54	0.017	-7.85	0.137
PA frequency	-0.36	0.342	0.54	0.045
PA duration	-0.32	0.22	-0.83	<0.001
PA intensity	-0.08	0.783	-0.03	0.874
Resident type	1.36	0.393	-0.72	0.512
Gender	-0.83	0.21	-1.43	0.003
Age	0.25	0.482	0.37	0.136
Education level	0.07	0.893	0.83	0.035
Student	-6.23	0.14	-1.26	0.663
Retired	-2.15	0.288	1.83	0.195
Full-time worker	-3.32	0.101	-0.44	0.752
Income	0.4	0.572	0.58	0.246
Habitual companion	-3.35	0.018	-1.64	0.09
Transportation convenience	0.52	0.576	0.53	0.409
On foot	-2.49	0.435	2.72	0.222
By bike	-0.94	0.765	4.26	0.056
By car	-2.43	0.347	4.42	0.017
Public transportation	-1.32	0.627	5.73	0.004
Time cost on the way	0.1	0.886	-0.22	0.634
Park	1.46	0.571	1.64	0.361
School	2.52	0.414	4.19	0.055
Home	-0.05	0.984	-0.62	0.706

Gymnasium	-0.33	0.911	3.02	0.143
Attractiveness	-0.59	0.197	-0.12	0.71
Historical and cultural atmosphere	-0.12	0.633	-0.45	0.015
Maintenance	0.26	0.547	0.31	0.306
Space size	0.23	0.425	0.41	0.045
Many shades	-0.07	0.788	0.22	0.202
Quietness	-0.27	0.31	-0.11	0.548
Air quality	-0.23	0.682	-0.07	0.849
Convenient facilities	0.33	0.344	-0.15	0.517
Observations	72		72	
R ² / R ² adjusted	0.382 / -0.069		0.808 / 0.668	

Table 3 Variable descriptive statistics table of characteristics of three parks, levels of PA, and health.

Statistic	Min	Pctl(25)	Mean	Pctl(75)	Max	Median	St. Dev.
PA.frequency	1	2	3.486	5	6	3	1.831
PA.duration	0	4	3.903	5	6	4	1.549
PA.intensity	2	4	4.789	5.5	8	4.4	1.448
Physical.health	0	15	14.528	15	15	15	2.049
Mental.health	-4	2.8	4.333	6	6	6	2.551
Resident type	0	1	0.792	1	1	1	0.409
Gender	0	0	0.5	1	1	0.5	0.504
Age	2	3.8	4.889	6	7	6	1.749
Education level	1	2.8	3.208	4	6	3	1.299
Student	0	0	0.069	0	1	0	0.256
Retired	0	0	0.681	1	1	1	0.47
Full-time worker	0	0	0.208	0	1	0	0.409
Income	1	1	1.792	2	4	2	0.918
Habitual companion	0	0	0.111	0	1	0	0.316

Transportation convenience	2	4	4.014	4	5	4	0.428
On foot	0	0	0.028	0	1	0	0.165
By bike	0	0	0.056	0	1	0	0.231
By car	0	0	0.097	0	1	0	0.298
Public transportation	0	1	0.792	1	1	1	0.409
Others	0	0	0.028	0	1	0	0.165
Time cost on the way	1	2	2.153	3	3	2	0.725
Park	0	0	0.653	1	1	1	0.479
School	0	0	0.083	0	1	0	0.278
Home	0	0	0.181	0	1	0	0.387
Gymnasium	0	0	0.042	0	1	0	0.201
Others	0	0	0.042	0	1	0	0.201
Attractiveness	4	6	6.472	7	7	7	0.839
Historical and cultural atmosphere	3	4	4.986	7	7	4.5	1.487
Maintenance	3	5	5.736	7	7	6	1.021
Largeness	2	4	5.25	7	7	6	1.545
Many shades	2	4	5.472	7	7	6	1.728
Quietness	2	4	5.194	6	7	5	1.43
Air quality	4	6	6.458	7	7	7	0.749
Convenient facilities	3	6	5.917	7	7	6	1.242

4. Discussion

The findings of the present research reveals that those famous historical and cultural parks are so attractive that local people living a little far away come to spend leisure time. According to Sihui G.'s(2019) study, the average service radius of historical parks is the largest among all types of parks in Beijing (Sihui, 2019). Those parks provide high-quality place for local people taking physical activities. There are also scheduled events organized by residents for taking activities in group

regularly which attractive dozens of people. Owing to a large amount of visitors coming to visit those famous parks on weekend, weekdays were the period when respondents came more often. In addition, respondents usually chose areas with fewer visitors to take physical activities.

Convenient transportation is a significant factor affecting frequency of physical activity. There are many bus stops and subway stations around those parks now. Most residents are satisfied with the transportation, while a few visitors think Xiangshan road—the road to the gate of Xiangshan park is a bit chaotic. Therefore, surrounding environment around the park needs to be focused on and improved.

Park characteristics especially shades is associated with duration of physical activity. For example, Xiangshan Park which possesses 0.27 million trees provides many shades and sitting areas in the mountains. According to semi-structured interview, visitors also prefer to run, walk or sit around the lake because of wide vision. Beihai Park and the Summer Palace both possess large lake that attract many runners and walkers. Thus, natural environment is important to stick to physical activities. Those historic parks relied on superior geographic environment which stick out from numerous parks in Beijing, attracting many local people.

Gender, education, place for taking activities and attractiveness are positive related to intensify of physical activity. According to our result, male is positive related to the intensity and frequency of physical activities. Previous studies also found that male is significantly positive in the frequency of physical activities in both Western and non-Western cities (Thi-Thanh-Hien, 2019, Baran, 2013, Özgüner, 2011, Sreetheran, 2017, Wang, D., 2015, Wright Wendel, 2012). Generally, men's physical capability is more stronger than women. This may explain that gender affects intensify of physical activity. As for frequency of physical activity, men had on average slightly more leisure time than women in China (Wei, Monika 2015) so that they can take physical activities more frequently. People with higher education level including associate and bachelor degree tend to take more intensive physical activities. This may be explained by location of the park. Those parks are all located in Haidian district, where universities, research institutions, and high-tech park are concentrated. Residents around are mostly from those institutions and more likely to get higher degree. Attractiveness is also a significant factor affecting intensity of the physical activity. Respondents were willing to spend time in place with attracting scenery. Those well-designed famous parks embodies the highest level of Chinese traditional garden art which attract plenty of local residents to take physical activities.

Physical health is significantly positive in habitual companion. Respondents who came to the park in group were in better physical health. Parks are charming places for them to spend time with family, friends and partners, to socialize, to participate in scheduled events, thus improving quality of life and well-being.

Mental health is positively associated with the frequency and duration of the physical activity, education level, and park characteristics (space size). Higher frequency and duration of the physical activity leads to better mental health. This finding was the same as previous studies indicate that higher frequency of physical activity was related to improve mental health (Abdullah, 2016). In addition, reviews reported that self-reported PA is associated with health-related quality of life (Bize et al., 2007). Respondents with higher education level also causes better mental health. This result was the same with the previous study finding marked association between educational status and the

likelihood of having sought mental health services (Leah et al. ,2007). Space size is also positively related to mental health. Large space with wide view may keep respondents pleasant mood and leads to better mental health.

However, historical and cultural atmosphere is not significantly related to the frequency and duration of physical activity and physical health. According to semi-structured interview, some of local residents did not feel strong historical and cultural atmosphere in those parks owing to lacking of historical knowledge and being accustomed to ancient architecture and gardens in Beijing. This means historical and cultural atmosphere are not primarily used for physical activity by respondents.

Based on the results of this research, it is recommended that future research could devote on different age of people such as teenagers. In addition, future research could compare historical parks to other types of parks. By doing this, more objective and specific strategies could be proposed for improving social value of historical parks.

5. Conclusion

This research explores relationships between park characteristics, physical activities and health in historical parks in Beijing, China. Some limitations are worth mentioning in this respect. The survey sample need to be more to improve the accuracy.

Our results confirm some tendencies of physical activity, characteristics of parks and health indicators observed elsewhere, but also revealed cultural and place-specific particularities. In contrast with western cities, safety is not a problem in Beijing. All areas are supervised. And because of crowded Asian cities' contexts, local residents taking physical activities need to avoid plenty of visitors which affects time and activity zones for physical activities in historical park. Such cultural and context-specific differences should be considered in theories of park use, park planning and historical park management (Thi-Thanh-Hien ,2019). Historical park and its surrounding environment need to be improved for more people to use. For example, in Beihai Park, more benches, toilet and navigation card need to be set in order to enhance convenience for park users, and some temporary architecture and surplus grass need to be changed into open space for people to take physical activities. In addition, historical parks need to disseminate history and culture to park users including local people, and closed area need to be open to make people get close to traditional culture as well as adding activity space, thus inheriting culture and making them more attractive.

China have experienced dramatic demographic urbanization and urban land expansion with the rapid economic growth during the past four decades (Sun, Zhao,2018, Zhao et al.,2015). Historical parks are part of urban green space and the symbol of Chinese culture. Urban historical parks play an important role in rehabilitating and revitalizing urban areas, and in strengthening physical activity of citizenship (United Nations, 2016). It is necessary to protect and revalorize historical park, and integrate culture and memory into social life, thus achieving the goal of cultural sustainability in the city.

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