Biodiversity and quality of urban green landscape affect mental restorativeness of residents in Multan, Pakistan

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Introduction: The influence of urban green spaces on public health is receiving unprecedented attention. Managing urban greenspaces sustainably requires an understanding of the mechanisms behind the positive effects of urban biodiversity on the wellbeing of residents. Urban parks could improve mental restoration of park users. The restoration potential may be influenced by the biophysical characteristics of the park.

Methods: This study aimed to understand two aspects of urban parks in Multan, Pakistan: (a) How does the perception of biodiversity and the quality of urban parks relate to mental restorativeness of park visitors? (b) What are the determinants of respondents' willingness to pay for the conservation and management of park biodiversity and quality in urban parks? Data were collected from October 2021 to December 2021 through a cross-sectional survey in which 550 park visitors were interviewed from six randomly selected urban parks in Multan. Multiple linear regression analysis, a binary logistic model, and a chi-square test were applied to analyze the data.

Results and discussion: The study empirically highlights the positive contribution of park visits to mental restorativeness. Biodiversity and quality were positively correlated with the mental restorativeness of park visitors. Sixty-two percent (62%) of the visitors were reluctant to pay, whereas 38% were ready to pay between Rs. 850/3.7$ and Rs. 1,700/7.4$ each year. Education, occupation, and monthly income significantly positively affected the respondent's WTP attitudes. The study highlights the importance of using urban parks as tools to promote mental restorativeness, combat social stress, and increase urban vegetation cover.

KEYWORDS

urban parks, park biodiversity, park quality, correlation, mental restorativeness, willingness to pay

1 Introduction

The contemporary world is rapidly urbanizing. By 2050, nearly 68% of the world's population is projected to live in urban areas (United Nations, 2019). Rapid urbanization has led to environmental and health-related problems for urban dwellers, which are worsened by the lack of interaction with nature (Manzoor et al., 2019). Environmental challenges such as overcrowding, excessive noise levels, pollution, powerful artificial lights, loss of biodiversity, and urban heat island negatively affect the physical and mental restorativeness of citizens (Galea et al., 2005).

In cities, urban parks are rare hotspots of nature (Leal Filho et al., 2020). Urban parks are critically important for human and ecological wellbeing. Access to green areas is important for healthy and livable cities (Parker and Simpson, 2020); a problem exacerbated during the

COVID-19 pandemic when social distancing restrictions increased pressure on the scarce supply of urban green space (Dempsey and Dobson, 2021). Urban parks provide a variety of ecosystem services (Mexia et al., 2018), such as noise pollution buffer (Margaritis and Kang, 2017), improved air quality (Hartig et al., 1997) and reduced heat stress (Lee et al., 2016). Urban parks offer opportunities for healthy activities, such as jogging trails, outdoor sports, and open spaces for social interaction (Almeida et al., 2018).

Recent research developments highlighted the importance of urban parks for the mental restoration of park users (Schnell et al., 2019; Schwartz et al., 2022). Mental restoration is the process of restoring a mentally exhausted individual or a person with increased negative effects to a condition in which these responses are decreased (Kaplan, 2001; Norling et al., 2010; Rydstedt and Johnsen, 2019). Urban parks contribute to mental restoration of citizens by allowing human-nature interaction (Menardo et al., 2021). Exposure to natural environments is associated with multiple health benefits such as rapid recovery from ailments (Ulrich, 1984), improved cognitive functioning (Berman et al., 2008), reduced mental fatigue (Kuo, 2001), and stress release (Yamaguchi et al., 2006).

There are many different features of urban parks that affect the mental restoration of park visitors. For example, biodiversity in urban green spaces is strongly correlated with the mental restoration of a human being. Biodiversity is defined as the "number of different species occurring in a given location" (Angermeier, 1994; Swingland, 2001). Exposure to a range of plant and animal species in urban parks improves mental restorativeness (Fuller et al., 2007) and the immune system in humans (Carrus et al., 2015). The perception of biodiversity is based on the visible features of the flora and fauna that allow people to differentiate between different species (Ekkel and de Vries, 2017). To understand the influence of park biodiversity elements on the mental restoration of park visitors, it is crucial to understand how people perceive biodiversity in urban parks.

In addition to biodiversity, park quality contributes to the mental restoration of park visitors (Nordh and Østby, 2013). The five broad characteristics that determine the overall quality are: the physical condition of the park, accessibility, user experience, community relevance, and adaptability (MacCleery et al., 2021). Cultural elements and amenities in urban parks have critical restorative value (Deng et al., 2020).

Given the importance of the biodiversity and quality of urban parks in the context of mental restoration, it is crucial to understand how much people value these characteristics of parks. In this context, Willingness to pay (WTP) is a commonly used indicator to assess respondents' interest and participation in the management and conservation of urban parks (Idris et al., 2022; Kalfas et al., 2022). The economic valuation of urban parks through WTP informs stakeholders how well society understands and values the ecosystem services provided by the scarce green spaces in cities. The idea of WTP makes it explicit to society that the conservation and management of urban parks have a cost that must be borne by society (Barrena et al., 2014).

In shaping our study, we've drawn insights from environmental psychology, particularly Kaplan's Attention Restoration Theory (ART) (Kaplan, 1995). This theory suggests that immersing oneself in natural surroundings can rejuvenate cognitive faculties and alleviate mental fatigue. It serves as the foundation for our exploration into how urban parks, as vital green spaces, contribute to revitalizing the mental wellbeing of park visitors. Additionally, we're guided by the Biophilia Hypothesis (Joye and De Block, 2011), emphasizing the inherent human connection with nature. This perspective helps us unravel how exposure to biodiversity in urban parks positively influences mental restorativeness. By intertwining these theories into our study, we aim to unveil the intricate ways in which park biodiversity and quality shape the mental wellbeing of urban residents, offering insights crucial for sustainable urban planning and park management.

This study was carried out in Multan, Pakistan, where our objective was to understand how biodiversity and park quality affect the mental restoration of park visitors and to what extent citizens understand the value of the environmental and health benefits offered by urban parks. This study aimed to understand two facets of urban parks in Multan: (a) How do the perception of biodiversity and the quality of urban parks relate to the mental restoration of people? (b) What are the determinants of the WTP of park users for the conservation and management of biodiversity and quality in urban parks?

2 Materials and methods

2.1 Description of the study area

Multan is located at Latitude 30° 11'52" north and Longitude 71° 28'11" east. Multan is located at an altitude of 414.8 feet. Multan City has a total area of 3,720 km². Multan division has a population of about 3.1 million and 42% of this population lives in Multan city. Multan city is characterized by a harsh climate. The area witnesses some of the most severe weather in the country, with the highest temperature recorded ever being around 52°C and the lowest temperature ever recorded being around 1°C (Hussain et al., 2021).

Multan is one of the biggest cities in the country. It is in the southern part of Punjab province. There have recently been many ecological challenges in this region, including floods, frequent heat waves, and consistently high summer temperatures. The city experienced some of the worst heat waves from March to April 2022, making it one of the world's ten hottest. Furthermore, the city has recently expanded at an exponential rate, consuming most of the vegetative cover in the last 20 years (Manzoor et al., 2019). In this ecologically fragile region, understanding the importance of urban parks in maintaining environmental and mental restorativeness is of critical importance.

2.2 Sampling of urban parks

Urban parks in Multan are managed by the Park and Horticultural Authority (PHA). PHA was established in 2014 and its mission is to make Multan "Green, Clean, and Beautiful." It is responsible for looking after and maintaining existing parks and developing new parks in the city. PHA Multan manages 59 parks which are divided into three administrative zones: A, B, and C.

TABLE 1 Six urban parks sampled from the three administrative zones (A, B & C) of Multan, Punjab, Pakistan.

	Size category	Park name	Park location	Park area
1	Large parks	Shashams Park	71.48228 ° E, 30.20402 ° N	39.8 acres
2	Large parks	Qila Kohna Qasim Bagh	71.47557° E, 30.19935° N	25 acres
3	Large parks	Ibn e Qasim Park	71.47503° E, 30.19984° N	11 acres
4	Small parks	Bagh Langhay Khan Park	71.45944° E, 30.19651° N	6 acres
5	Small parks	Officer's Colony Park	71.47501° E, 30.21092° N	2.1 acres
6	Small parks	Allama Iqbal Park	71.45359° E, 30.19327° N	2 acres

To draw a representative sample of parks, we subdivided parks in each administrative zone into two classes according to the size of the park: large parks (more than 10 acres), and small-sized parks (<10 acres). We then randomly selected two large and two small parks from each administrative zone. The details of the six selected parks are given in Table 1.

2.3 Survey methods

Data for this study was collected through a cross-sectional survey in which 550 park visitors were interviewed in the sampled parks of the city. To ensure a clear delineation of the study's scope and participant eligibility, we stipulated that all included participants were above the age of 18, thereby encompassing a diverse population of adult park visitors in our investigation. Face-to-face interviews were conducted to assess the perceptions of park biodiversity and quality of the park and WTP for the conservation and management of biodiversity and quality in the urban parks of the city.

Data was collected from October 2021 to December 2021. On weekdays, questionnaires were completed in the early morning or late afternoon and on weekends, throughout the day. The purpose of the interview was explained to the respondents prior to the interview (Amanda, 2023).

A semi-structured questionnaire was used which was divided into five sections:

In the first section, demographic data were collected (gender, age, occupation, individual monthly income, and residence).
In the second section, respondents were asked about their routine of visiting the park. The respondents were asked about the number of trips to the park they make in a month, how long they stay in the park during a visit, and their purpose for visiting the park.
In the third section, we asked questions related to the mental restoration of park visitors. The "Perceived Restorativeness Scale" was used to examine mental restoration. This scale was developed by Hartig et al. (1997) and is used to measure the restorative characteristics of the environment (Takayama et al., 2019; Gonçalves et al., 2021). The Perceived Restorativeness Scale consisted of eight constructs. Two questions constituted each construct. The responses to all the questions were recorded on a Likert scale (1–5, ranging from strongly disagree to strongly agree). A Cronbach alpha value of 0.63 confirmed that the constructs of the scale were internally consistent (Taber, 2018).

In the fourth section of the questionnaire, we asked questions to assess the perceived quality of parks. We asked questions about the number and variety of amenities and facilities in the parks, their management standards, and overall cleanliness. Each item was assessed on a scale of 1 (very poor condition of amenities/facilities and non-availability of signboards) to 5 (very good condition of amenities/facilities and availability of signboards). The scores were then added to compute a space quality score (i.e., "park quality").

In the fifth section, we assessed the WTP of the park visitors for the conservation and management of biodiversity and quality in the urban parks of the city. Visitors were asked if they would be willing to financially contribute to the conservation and management of biodiversity and quality in the parks. The reasons for their willingness (or unwillingness) to pay were recorded.

A copy of the questionnaire draft can be accessed in Supplementary file S1.

2.4 Hypotheses formulation

To assess whether the mental restorativeness of park visitors is affected by the park biodiversity and park quality, we proposed the following hypotheses:

Hypothesis H_1:
Null: The mental restoration of park visitors is independent of the park biodiversity.
Alternate: Mental restoration of park visitors is not independent of park biodiversity.
Hypothesis H_2:
Null: Mental restoration of park visitors is independent of the park quality.
Alternate: Mental restoration of park visitors is not independent of the quality of the park.
Hypothesis H_3:
Null: The WTP is independent of their demographic background.
Alternate: The WTP is not independent of their demographic background.

2.5 Statistical analysis

A multiple linear regression analysis was used to investigate the effect of park biodiversity and quality on mental restorativeness (hypotheses H_1 and H_2). The dependent variable (mental restoration) was regressed against the independent variables (park biodiversity and park quality).

For hypothesis H_3, a binary choice model was used to determine if a respondent was WTP or not for the conservation and management of biodiversity and quality. In the binary choice model, WTP was the response variable with two levels (Yes/No), while the demographic variables were the independent variables used in the model.

Furthermore, descriptive statistical analyzes were carried out to compute frequencies and percentages of the responses. All statistical analyzes were carried out in JASP (Version 0.16.3).

In utilizing the Perceived Restorativeness Scale (PRS) for this study, we would like to explicitly acknowledge the prior validation conducted by Takayama et al. (2019), Subiza-Pérez et al. (2020), and Gonçalves et al. (2021), which established the credibility of the scale. While we did not conduct a separate validation in our study, we focused on assessing the internal consistency using Cronbach's alpha, revealing a moderate level of reliability.

3 Results

3.1 Demographic characteristics

The demographic characteristics of the urban park visitors in Multan city are summarized in Table 2. The City attracts visitors from a wide range of demographic backgrounds. In general, (32.9%) of the respondents were between the ages of the 20 and 29 years, while (26.2%) of respondents were between 30 and 39 years old. 42.9% of the respondents attended a secondary and high school, followed by those who had attended a university (36.4%). Most of the respondents (29.8%) earned Rs. 30,000–40,000/131–172$ per month. 62.4% of the respondents identified themselves as male, while 37.6% identified themselves as female.

3.2 Factors influencing mental restoration of park visitors

A linear regression analysis was used to investigate the effect of park biodiversity and quality on mental restorativeness (hypotheses H_1 and H_2). The dependent variable (mental restoration) was regressed against park biodiversity and park quality. The results suggested a significant relationship between the independent variables and mental restoration ($F = 23.391$, $p < 0.005$, $R^2 = 0.41$). Park biodiversity showed a significant and positive impact on mental restoration ($\beta = 0.030$, $t = 4.836$, $p = 0.0000$). Therefore, we found evidence to reject the H_1 null hypothesis. Furthermore, the results show that the quality of the park has a significantly positive impact on mental restoration ($\beta = 0.033$, $t = 9.699$, $p = 0.0000$). Consequently, there is evidence to reject the H_2 null hypothesis. The detailed results of the regression analysis are presented in Table 3.

TABLE 2 Demographic profile of the respondents (percentage and number of respondents) included in the survey study ($n = 550$).

Variable	Levels	Frequency	Percentage
Gender	Male	343	62.4
	Female	207	37.6
Age	<20	48	8.7
	20–29	181	32.9
	30–39	144	26.2
	40–49	81	14.7
	50–59	73	13.3
	>60	23	4.2
Education	Illiterate	39	7.1
	Primary	75	13.6
	Secondary/high secondary	236	42.9
	Graduate	200	36.4
Occupation	Salaried	166	30.2
	Freelancer	67	12.2
	Businessman	141	25.6
	Unemployed	162	29.5
	Retired	14	2.5
Monthly income	Zero	159	28.9
	<Rs. 15,000/65$	29	5.3
	Rs. 15–30,000/65–131$	135	24.5
	Rs. 30–40,000/131–172$	164	29.8
	Rs. 40–100,000/172–438$	62	11.3
	Rs. >100,000/>438$	1	0.2
Residence location	Multan (urban)	328	59.6
	Multan (rural)	148	26.9
	Out of Multan (urban)	61	11.1
	Out of Multan (rural)	13	2.4

3.3 Public complaints about urban parks of Multan

The results of this study suggest that 34.2% of the park visitors had no complaints about the parks. 27.8% of the respondents highlight the lack of disposable waste facilities as the main issue in urban parks of Multan, followed by a lack of washroom facilities (19.1%), limited entertainment facilities for children (12.4%), and lack of fresh water supply (11.8%, Figure 1).

TABLE 3 Results of the multiple linear regression model predicting the mental restoration using demographic variables of the respondents as independent variables.

Hypotheses	Regression weights	B	t	p-value	Results
H1	PB → MR	0.030	4.836	0.000*	Supported
H2	PQ → MR	0.033	9.699	0.000*	Supported
R^2	0.41 or 41%				
F	23.391				

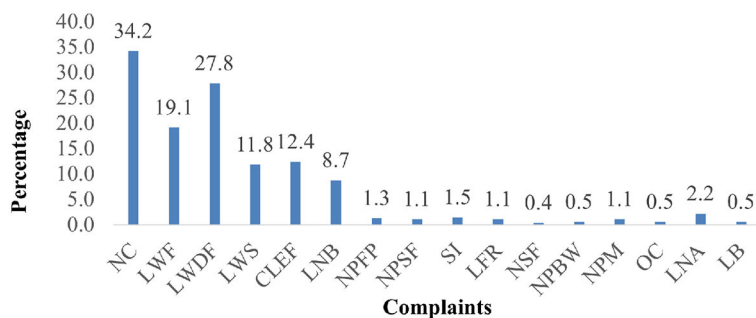*$p < 0.05$, PB, park biodiversity; PQ, park quality; MR, mental restoration.

FIGURE 1
Public complaints about facilities in the parks of Multan, Pakistan (n = 550). NC, no complaints; LWF, lack of washroom facility; LWDF, lack of waste disposable facility; LWS, lack of fresh water supply; CLEF, children have limited entertainment facilities; LNB, lack of setting facility; NPFP, no proper facility for offering prayers; SI, security issues; LFR, limited facilities for refreshment; NSF, no swimming facility; NPBW, no proper boundary wall; NPM, no proper management; OC, overcrowded; LNA, less natural aesthetics; LB, less biodiversity.
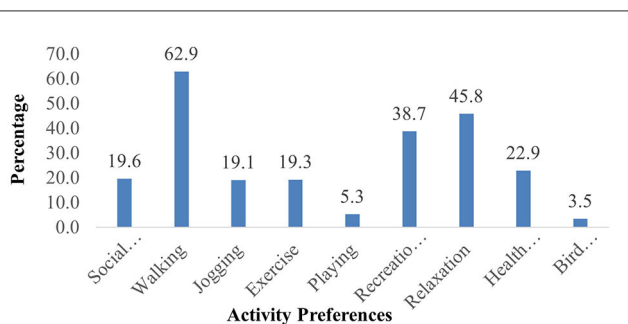

FIGURE 2
Respondents' reasons for visiting urban parks in Multan, Pakistan (n = 550).

TABLE 4 Details of the amount of money the respondents give are WTP for the conservation and management of biodiversity and quality in Multan urban parks, Pakistan ($n = 550$).

Amount of WTP (Rs. per year)	Frequency	Percentage
Not willing to pay	341	62.0
More than 850 PKR	162	29.5
More than 1,700 PKR	47	8.5

3.4 Activity preferences of park visitors

The results of the study concluded that most people visit parks in Multan for a walk (62.9%), followed by relaxation (45.8%), recreational tourism (38.7%), health &fitness (22.9%), social interaction (19.6%) and exercise (19.3%), respectively, as shown in Figure 2.

3.5 Estimation of the willingness to pay

Table 4 provides summary data of WTP responses in six urban parks in Multan City. Thirty-eight percentage of the respondents

were willing to pay between Rs. 850/3.7$ and Rs. 1,700/7.4$ each year. However, 62% of the respondents were unwilling to pay anything at all.

Table 5 shows the various reasons why the respondents were willing to pay for the conservation and management of biodiversity and quality in the urban parks of Multan, Pakistan. The results show that 16.9% of the respondents were willing to contribute, wanting to keep Multan's urban parks in existence to benefit themselves; 11.3% were willing to pay to retain a future use opportunity and sustain these urban parks for future generations; and 9.8% believed that their contribution would help to conserve these urban parks and, in turn, contribute to mitigating climate change.

Table 6 shows the reasons for the unwillingness of respondents to contribute to the conservation and management of biodiversity and quality in Multan urban parks, Pakistan. A quarter of the non-contributors believed the government should provide financial support to help manage the urban parks, 7.3% argued that they

TABLE 5 Respondent's reasons to pay for the conservation and management of biodiversity and quality in the urban parks of Multan, Pakistan (n = 550).

Reasons for paying	Number of respondents	Percentage
Not willing to pay	341	62.0
WTP to benefit me	93	16.9
WTP for the sake of the coming generation	62	11.3
WTP to mitigate climate change	54	9.8
Total	550	100.0

TABLE 6 Respondent's reasons for not paying for the conservation and management of biodiversity and quality of urban parks.

Reasons for not paying	No. of respondents	Percentage
No reason	210	38.0
The funds should be provided by the government	175	31.8
I want to contribute, but I have no spare income	40	7.3
I fear that the funds will not be used for conservation	106	19.3
I am far from park areas; such a thing is unimportant to me	19	3.5
Total	550	100

had no extra money to contribute, 19% stated that they would not contribute because they did not believe the funds would be effectively used for park conservation and management, and 3.5% stated that they live too far away from these urban parks to care about their upkeep and development.

3.6 Factors influencing WTP

A binary logistic regression model was used to investigate characteristics that could influence respondents' WTP for the conservation and the management and quality of urban parks. For Hypothesis H_3, the null hypothesis is rejected, showing that the independent variables of the logistic regression model significantly affect the respondents' WTP of the respondents for the conservation and management of park biodiversity and quality. Table 7 shows the highest likelihood estimates for the logistic regression model. The null hypothesis that the coefficient estimates were equal to zero was rejected at a confidence interval of 95%.

The three independent variables—education, occupation, and monthly income—had a positive (β-values equal to 0.485, 0.371, and 0.788, respectively) significant effect (p = 0.001, 0.001 and 0.005 < 0.05) on the respondents WTP.

Table 8 shows that monthly income, occupation, and education had a substantial impact on WTP bids. The findings revealed that monthly income (χ^2 = 106.96, p = 0.000), occupation

TABLE 7 The results of a binary logistic regression model modeling the respondent's WTP for the conservation and management of biodiversity and quality.

Variables	β	S.E.	Wald	df	Sig.	Exp (B)
Gender	0.241	0.219	1.209	1	0.272	1.272
Age	−0.034	0.100	0.112	1	0.738	0.967
Education	0.485	0.152	10.175	1	0.001	1.625
Occupation	0.371	0.116	10.264	1	0.001	1.449
Monthly income	0.788	0.126	38.986	1	0.000	2.199
Residence location	−0.171	0.127	1.822	1	0.177	0.843

(χ^2 = 88.97, p = 0.000), and education (χ^2 = 55.18, p = 0.000) were the most important factors influencing the WTP bids. Those respondents who had a monthly income between PKR 40,000 to 100,000 and 30,000 to 40,000 showed 40.2% and 22% WTP for the conservation and management of biodiversity and quality. Respondents whose fall in the graduate and secondary/high secondary categories showed 47.8 and 47.4% WTP. Respondents who fall into the primary and illiterate category showed 2.9 and 1.9% WTP. Similarly, those respondents who are a businessman and salaried paid employees showed 39.2 and 32.5% WTP while freelancer, unemployed, and retired respondents showed 13.9, 8.6, and 5.7% WTP, respectively.

4 Discussion

The link between urban parks and mental restorativeness has gained attention in recent years, particularly in developing nations. In this study, our objective was to understand how biodiversity and park quality affect the mental restoration of park visitors.

Our research supports earlier studies that empirically demonstrate the beneficial effects of park visitation on mental restorativeness (Groenewegen et al., 2006; Nisbet et al., 2011; White et al., 2013; Liu et al., 2017; Schnell et al., 2019; Schwartz et al., 2022). In this study, we found that the biodiversity of the park has a significant and positive impact (β = 0.030, t = 4.836, p = 0.00) on mental wellbeing. Evidence suggests that green spaces with higher biodiversity are related to better mental restorativeness compared to green spaces low in biodiversity (Carrus et al., 2015; Wood et al., 2018). Urban parks that are richer and more diverse provide more healing advantages than those that are simpler and only have grass and trees. Fuller et al. (2007) showed that there is a connection between biodiversity and psychological health in Sheffield parks and found that the benefits of visiting urban parks were higher when there were more species of both birds and plants. Similar findings were made by Cox et al. (2017), who reported that in urban parks, the number of birds and the amount of vegetation reduced the intensity of depression, stress, and anxiety. The profusion of wildlife, plants, and birds is positively correlated with mental recovery (Southon et al., 2018).

The relationship between the presence of trees and mental restorativeness showed that trees act as a proxy for perceived "naturalness" and increase mental wellbeing (Dallimer et al., 2012).

TABLE 8 The results of the chi-square tests show the relationship between the demographic variables of the respondents and the various levels of financial contributions they are willing to make for the conservation and management of biodiversity and quality in the urban parks of Multan, Pakistan ($n = 550$).

Variables	Gender	Age	Education	Occupation	Monthly income	Residence location
χ^2 value	10.254	29.89	55.18	88.97	106.96	30.24
Df	1	5	3	4	5	3
Asymp. sig.	0.001	0.000	0.000	0.000	0.000	0.000

Vegetation loss and its psychological effects on individuals and societies cannot be ignored. Evidence suggests that people who reside in areas with the least green space have a 24% higher risk of developing schizophrenia (Rotenberg et al., 2022). Anxiety, impatience, and stress cannot be solely attributed to personal or family issues but could be caused by a "disconnection" from the natural world.

Our results suggest that the quality of the park has a significantly positive impact ($\beta = 0.033$, $t = 9.699$, $p = 0.00$) on the mental restoration of park visitors. Previous studies on this subject support our result (Rosso et al., 2011; Carlson et al., 2012; Nordh and Østby, 2013; Deng et al., 2020). The quality of urban parks can be assessed from users' perception of the quality of furniture, management, and cultural cues in parks and how accessible and safe users find the parks (Roberts et al., 2019). The park quality indicators may also include lights, seats, signage, lush green grass, and overall cleanliness in the park. Park quality can also be assessed from an ecosystem-wide perspective by evaluating species diversity, habitat diversity, or ecosystem services (Sandifer et al., 2015).

Digging deeper into what park visitors had to say about their experiences brings more insights to the table. Complaints like the absence of proper waste facilities and a shortage of activities for kids shed light on the real challenges visitors encounter. Addressing these concerns directly can guide us in making specific improvements to the park setup, ensuring it aligns better with what visitors actually need. And when we take a closer look at how people like to spend their time in urban parks, it reveals a spectrum of preferences. Customizing park facilities and activities based on these preferences becomes a way to create a more engaging and varied experience for the whole community.

From the management perceptive, it is important to know how people value biodiversity, facilities, and other features of parks. Urban parks provide ecological benefits, although they are not always obvious (Buchel and Frantzeskaki, 2015). It is essential to investigate which ecosystem services are valued by residents to assess the quality and value of urban parks (Li et al., 2019). Public opinion of urban parks helps both prioritize the provision of ecosystem services and to assess park quality using social indicators (Buchel and Frantzeskaki, 2015). In this regard, WTP is a frequently used indicator to assess respondents' interest and involvement in the management and conservation of urban parks (Song et al., 2015; Expósito et al., 2021; Malik et al., 2021). The study also investigated the determinants of the WTP of park users for the conservation and management of biodiversity and quality in urban parks. Sixty-two percentage of the respondents in our study were not WTP, while the remaining 38% were WTP between Rs. 850/3.7$ and Rs. 1,700/7.4$ each year for the biodiversity conservation and management and quality efforts in the urban parks of Multan. Our result is contradictory to the previous study carried out by Malik et al. (2021) regarding WTP for the conservation of trees in the urban parks of Multan. This could be attributed to the fact that people easily understand the benefits of trees in urban parks and show their willingness for tree conservation only. The local community may not be fully aware of the idea of conservation and management of park biodiversity and park quality.

The differences we see in how many people are willing to pitch in WTP lead us to dig deeper into what's behind these varied attitudes. With 38% ready to chip in financially, it's crucial to get to the bottom of why. Figuring out the detailed motivations driving their choices—whether it's for personal gain, future prospects, or a bigger picture of preserving nature—can shape how we communicate about it. At the same time, understanding the reasons some aren't willing, like counting on government help or doubts about how the funds would be used, points to obstacles that we should deal with. Tackling these barriers could help get wider community backing for looking after the parks.

The study demonstrates that the WTP of park visitors is determined by three main demographic independent variables: education, occupation, and monthly income. These variables had a positive significant effect on the attitude of the WTP of the respondents. Malik et al. (2021) also found that education, occupation, and monthly income are the contributing factors that predict the WTP for the conservation and management of biodiversity and quality in urban parks. Numerous studies have shown an association between WTP for environmental causes and education (Marbuah, 2019). Better education often leads to greater information on biodiversity conservation and management challenges, increasing an individual WTP for environmental protection (Franzen and Vogl, 2013). It is also observed that compared to the less wealthy individuals, the wealthier individuals are frequently more ready to pay for biodiversity conservation and management. Our income finding supports the prosperity assumption, which states that more rich people will be able to spend more on environmental products than less wealthy people under the constrained budget and same preferences (Marbuah, 2019).

Natural habitats are becoming more widely acknowledged for the potential of practice and policy to enhance human wellbeing and health. Attention Restoration Theory (ART) is widely used to describe how this could be accomplished. According to ART, the increased demands on focused attention may contribute to fatigue (Kaplan, 1995). We may regain attention by taking time away from the attention-demanding duties of daily living and spending time in natural surroundings that do not drain our cognitive resources. The human population is growing more crowded in

cities, there is concern that people may grow more cut off from nature. ART claimed that access to green spaces in urban contexts could aid in reducing the mental fatigue of modern life due to "psychological restoration". The last several decades have seen a significant increase in research on the connection between urban park biodiversity and quality with mental repair (Sandifer et al., 2015), particularly in developing countries. Our study adds weight to the claim that park biodiversity and park quality have an impact on the mental restorativeness of park visitors. Our research supports earlier studies that empirically demonstrate the beneficial effects of park visitation on mental restoration (Groenewegen et al., 2006; White et al., 2013).

4.1 Implications of the study

Extending the discussion to broader social and policy implications, our findings signal the potential of urban parks not only as spaces for recreation but as integral components of public health strategies. The identified positive impact of park quality and biodiversity on mental restoration invites consideration in urban planning and policymaking. Advocating for the integration of green spaces into urban development plans and health initiatives can be a key takeaway. Moreover, our results underscore the importance of transparent park management and fundraising mechanisms, suggesting potential improvements in governance structures that could enhance public trust and participation in conservation efforts.

Our findings highlight the need for larger and higher-quality urban parks, where more biodiversity might give "softly appealing" (Kaplan, 1995) stimuli to stressed-out individuals. This is especially significant in Pakistan, where depressive problems are common (Muhammad Gadit and Mugford, 2007; Cassum, 2014; Khan et al., 2021). Our findings could potentially have major implications for the country's expanding urban forest trend. According to the Ministry of Climate Change in Pakistan, 126 urban forest initiatives using the Miyawaki method are being developed nationwide (51 in Lahore, 50 in KPK, 20 in Islamabad, and five in Karachi). Although reducing climate change is the main goal of these urban forests, authorities have a great opportunity to use these green areas to treat increasing social stress in the community by constructing amenities that will improve user experience and guarantee a rich biodiversity environment.

Based on the research results, the following suggestions are proposed for better urban park management in the future. First, urban park visitors in Multan value a diverse range of services and natural utilities, therefore urban parks of Multan city should be managed to facilitate the needs of the park visitors. This could not only improve the user experience for park visitors but could also result in potential income for PHA through park use fees. Second, given the strong relationship between park use and mental restorativeness, medical professionals and hospital committees should be encouraged to prescribe park visitation as part of the treatment to cure depression, hypertension, and other conditions related to mental wellbeing. Third, fundraising campaigns should be run by the PHA in the affluent parts of the cities. Since our results suggest that the

literature and high-income individuals are more likely to pay for the conservation and management of urban parks, such campaigns can generate considerable funds to support PHA activities in Multan, Pakistan. Furthermore, to build trust among the masses, a transparent mechanism of funds collection and use should be introduced to encourage people to freely contribute to park management fundraisers.

4.2 Limitations of the study

While our study contributes valuable insights into the interplay between urban park characteristics, mental restoration, and willingness to pay for conservation, it is essential to acknowledge certain limitations that influence the interpretation and generalizability of our findings. Firstly, the geographical specificity of our study, centered in Multan, Pakistan, raises caution about the universal applicability of our results. The unique ecological challenges, recent climatic events, and rapid urbanization patterns in Multan may limit the broader generalization of our conclusions to areas with distinct environmental dynamics. Additionally, our sampling strategy, based on the size classification of parks and focus on those managed by the Park and Horticultural Authority (PHA), might introduce bias, potentially overlooking the diversity of urban green spaces. The timing of our survey from October to December 2021 may not fully capture seasonal variations, impacting the comprehensiveness of our understanding of park visitation patterns and respondent perceptions. Furthermore, reliance on self-reported data through face-to-face interviews introduces the potential for social desirability bias and memory recall issues. These limitations underscore the need for cautious interpretation and pave the way for future research to address these constraints and further enrich our understanding of the intricate relationships within urban park dynamics.

5 Conclusions

The study scientifically demonstrates the positive impact of park visits on the mental restorativeness of park visitors. Both the biodiversity and quality positively correlated with the mental restoration of park visitors. Sixty-two percent (62%) of the visitors were hesitant to pay, whereas 38% were ready to pay between Rs. 850/3.7$ and Rs. 1,700/7.4$ each year for the conservation and management of park biodiversity and quality. Most non-contributors believed the funds would not be effectively used by government authorities. Education, occupation, and monthly income are the three demographic factors that had a significant effect on the attitude of the WTP of the respondents. Private-public partnership is critical to the sustainable management of urban parks. There is a dire need to involve public urban park management in Multan by raising awareness of the significance of the parks for mental wellbeing, raising funds for the conservation and management of parks, and earning public trust through transparent systems of fund collection and utilization.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

ZR: Investigation, Methodology, Software, Writing – original draft. MZ: Data curation, Formal analysis, Methodology, Supervision, Writing – review & editing. DH: Funding acquisition, Project administration, Resources, Writing – review & editing. SM: Conceptualization, Formal analysis, Methodology, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/frsc.2023.1286125/full#supplementary-material

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