

Bird Sounds Psychological Restorative Effect on The Visitors of Bogor Botanical Garden

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ABSTRACT

Stress can be defined as psychological and physical tension caused by physical, emotional, social, economic, and occupational, events, or experiences that are difficult to manage or endure. Bird sounds can be a potential solution to reduce stress levels. This study aimed to analyze the effect of bird sounds as a stress restorative on Bogor Botanical Garden visitors. A survey of 100 visitors of Bogor Botanical Garden was conducted based on the Perceived Stress Scale and Perceived Restorativeness Soundscape Scale. Data on respondent characteristics were analyzed using descriptive analysis, the relationship between stress levels and perceived stress restorative effect of bird sound was analyzed using Pearson correlation analysis. The analysis showed that 78% of respondents had moderate to high perceived stress levels and 98% of respondents rated the degree of restoration from bird sounds to be moderate to high. The correlation analysis revealed a negative relationship between the stress level and bird sounds' perceived restorative effect. The older the respondents and the more frequently they visited Bogor Botanical Garden, the higher the perceived stress restorative effect from bird sound.

1. Introduction

Stress can be defined as psychological and physical tension caused by physical, emotional, social, economic, and occupational, events or experiences that are difficult to manage or endure (Colman 2015). Stress can be triggered by the presence of stressors (Anakwenze and Zuberi 2013), such as fear, anxiety, life demands, and job loss (Klinik Community Health Center 2010). Nowadays, stress has become a part of everyday life (Iwata *et al.* 2013). This was due to the ever-increasing work (Salleh 2008) and social (Anakwenze and Zuberi 2013) pressure felt by the society. Although experiencing little stress can be a good thing (Dhabhar 2014), prolonged stress could lead to psychological distress, leading to a more severe mental problem such as depression (Iwata *et al.* 2013). In Indonesia, according to The Indonesian Ministry of Health (Badan Penelitian dan

Pengembangan Kesehatan 2013, 2019), the national prevalence of psychological distress increased from 6% in 2013 to 9.9% in 2018. This condition was exacerbated by the occurrence of the COVID-19 pandemic, which increased the stress level of Indonesian people (Kaligis *et al.* 2020).

Despite worsening psychological conditions, the pandemic has had positive effects on improving the environmental quality of (Bar 2021) and bird activity in urban areas (Gordo *et al.* 2021). Schrimpf *et al.* (2021) also found that as many as 80% of bird species experienced an increase in population in urban areas during the lockdown. An increase in activity and bird population in urban areas is one of the potentials that can be utilized to reduce stress levels (Aerts *et al.* 2018; Cox *et al.* 2017; Marselle *et al.* 2019). Various previous studies showed that bird sounds are considered to have a therapeutic effect on reducing a person's stress level (Fisher *et al.* 2021; Uebel *et al.* 2021; Zhu *et al.* 2020). Based on Zhu *et al.* (2020), bird sounds exert a significant stress-restorative effect in urban forests. Ferraro *et al.* (2020) also found that bird sounds on hiking

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trails in McClintock and Gregory Canyon increased the psychological recovery effect of climbers.

The fact that prevalence of depression in urban areas in all of Indonesia (6.3%) is greater than in rural areas (5.8%) (Badan Penelitian dan Pengembangan Kesehatan 2019), making the existence of places that can provide opportunities for interaction between communities and birds to be important in the urban area, as a means of affordable and easily accessible stress reduction and recovery. Bogor Botanical Garden (KRB) is an urban forest park located in the middle of Bogor City which is regularly visited by many people from Bogor City and Jakarta City, which has a high level of bird diversity that tends to increase from 2014 to 2018. (Sukara *et al.* 2014; Wahyuni *et al.* 2018). According to Wahyuni *et al.* (2018) and Kurnia *et al.* (2021), KRB has as many as more than 80% of bird species found in all Bogor parks and green spaces.

This study aimed to analyze bird sounds restorative stress effect on Bogor Botanical Garden visitors. First, we measured visitors' stress levels. We measured the level of the perceived stress restorative effect of bird sounds, next we identified the relationship between visitors' stress levels and the perceived stress restorative effect of bird sounds. Finally, we identified visitor's characteristics that affect the degree of perceived stress restorative effect of bird sounds.

2. Materials and Methods

2.1. Study Time and Location

This study was conducted from January to February 2022 at the Bogor Botanical Gardens (KRB), Bogor City, West Java Province. The selection of interview locations was carried out randomly throughout the Bogor Botanical Gardens, and the interviews were carried out on the spot.

2.2. Tools and Instruments

The tools used during this study were a headset and a recorder to listen to recorded bird sounds. The bird sounds recording used was

from a video with mixed bird sounds and had a duration of 20 minutes. The sound of birds that were heard comes from videos of bird sounds by The Silent Watcher downloaded from https://www.youtube.com/watch?v=Qm846KdZN_c&ab_channel=TheSilentWatcher. The instruments used are the interview guides and questionnaire forms.

2.3. Ethical Approval

This study has been ethically approved by the Human Research Ethics Committee of the Bogor Agricultural University with letter number 617/IT3. KEPMSM-IPB/SK/2021.

2.4. Survey Procedure

A total of 100 respondents were selected by random and accidental sampling techniques. In the random sampling technique, each visitor has the same possibility of being chosen as a respondent. The accidental sampling technique is a technique for selecting respondents based on ease and willingness to be interviewed. In the unintentional sampling technique, respondents were selected by chance who were close to the researcher (Etikan *et al.* 2016) and were willing to be interviewed.

Interviews were conducted face-to-face in compliance with existing health protocols. This was done because the respondents were KRB visitors, so the face-to-face method was chosen to be more targeted. The interview consisted of 4 stages, namely: 1) introduction to the study and questionnaires, 2) respondents were asked to fill in visitor profile data, 3) respondents were asked to measure the level of perceived stress, 4) respondents answered questions about perceptions of the stress-restorative effect of bird sounds (PRSS) while listening to recorded bird sounds.

2.5. Questionnaire

The questionnaire consists of respondent demographic characteristics, visit characteristics, Perceived Stress Scale (PSS), and Perceived Restorativeness Soundscape Scale (PRSS) (Table 1).

Table 1. Questionnaire parts

Questionnaire	Items
Demographic characteristics	Gender, age, place of residence, education, occupation, income, bird enthusiast, perception of KRB
Visit's characteristics	Frequency of visits, length of visit, travel time, and purpose of visit
PSS	Visitor stress level
PRSS	Perceived stress restorative effect of bird sound

The level of perceived stress by respondents in January-February 2022 was measured using the Perceived Stress Scale (PSS). The PSS is a questionnaire that measures an individual's response to an event that has occurred and can cause stress within one month period (Cohen *et al.* 1983, 2007). Based on Joshi and Vaidya (2017) PSS has been used in several studies to assess the effectiveness of stress-reducing interventions. According to Chiang and Li (2019), PSS measures the degree of perceived stress by measuring perceived helplessness and self-efficacy. PSS consisted of 10 items of statements (six negative and four positive statements) with a response based on a five-point Likert scale (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, and 4 = very often) that produces a score between 0 to 40 (Cohen *et al.* 1983). Positively stated items were reverse-coded before being summed up. The categories of stress levels based on Backhaus *et al.* (2020) were low-stress level (0-13), moderate stress level (14-26), and high-stress level (27-40).

The perceived stress-restorative effect of bird sounds was determined using the Perceived Restorativeness Soundscape Scale (PRSS; Payne and Guastavino 2013, 2018). The PRSS consists of 22 statement items (Payne and Guastavino 2018) which are then adapted to the needs of this research by changing the PRSS theme from "sounds in general" to "bird sounds". PRSS is a scale developed from the Perceived Restorativeness Scale (PRS; Hartig *et al.* 1997) by Payne (2013) to measure the level of perception of the four components of Attention Restorative Theory (ART; Kaplan and Kaplan 1989), that are Fascination, Being-Away, Compatibility, and Extend, in relation to sound. Fascinations consisted of 4 items (such as "These bird sounds, I find fascinating"). Being-Away consisted of 6 items (such as "I feel free from work and/or responsibilities when I am with these bird sounds"). Compatibility consisted of 4 items (such as "I rapidly adapt to these bird sounds"). Extend-Coherence consisted of

4 items (such as "These bird sounds are coherent"), and Extend-Scope consisted of 5 items (such as "There are plenty of bird sounds to allow exploration in many directions").

The respondents were asked to give their responses to the given statements while hearing recorded bird sounds. The response to each statement was based on a seven-point Likert scale from completely disagree (1) to completely agree (7). The points were then summed up with resulting values ranging between 22 to 154, higher values indicate higher restorative qualities (Qiu and Zhang 2021). The total values were then divided into three categories for easier interpretation. The restorative level categories of PRSS scores are low (22-65), moderate (66-109), and high (110-154).

2.6. Data Analysis

Visitor profile data (demographic and visits characteristics), respondent's stress level, and level of stress restorative effect from bird sound were analyzed using frequency analysis and descriptive analysis. The relationship between respondents' stress levels and the stress restorative effect of bird sounds was analyzed using a linear regression method. To identify the characteristics of the respondents that affect the stress restorative effect of bird sounds, a stepwise linear regression method was used for quantitative data and Chi-square analysis for qualitative data. The details of the qualitative and quantitative data can be seen in Table 2.

Table 2. Data analysis details

Types of data	Data	Analysis
Quantitative (continues)	Age, place of residence, education, income, frequency of visits, length of visit, and travel time	Stepwise linear regression
Qualitative (categorical)	Gender, occupation, the purpose of visit, and bird enthusiast	Chi-square

3. Results

3.1. Visitors Profile

3.1.1. Demographic Characteristics

The results showed that 72% of respondents who visited KRB during January-February 2022 were female (Table 3), the highest percentage of respondents' age ranged from 19-25 years (59%) with an average of 25.14 years and with the majority living in Bogor (52% from Bogor Regency). As many as 55% of respondents graduated from high school, and a majority of the respondents were college students (38%). More than 70% of respondents had incomes below Rp. 5,000,000.

3.1.2. Visits Characteristics

It can be seen from Table 4, 84% of respondents visited KRB once in the period of January-February 2022, with the majority of the visits being 1-3 hours (55%). The most common purpose for visiting was to enjoy the beauty of nature (50%). The result showed that 55% of respondents took more than 45 minutes

from home to KRB and 76% of respondents stated that they are not bird enthusiasts.

3.2. Respondents' Stress Level and Stress Restorative Effects of Bird Sounds

The results from the interview on respondents' stress levels showed that 22% of respondents had low-stress levels, 73% had moderate stress levels, and 5% had high-stress levels. Furthermore, about respondents' perception of KRB, all (100%) respondents stated that they felt comfortable and calm when visiting KRB and as many as 97% stated that visiting KRB could reduce their stress levels. The interview about the stress restorative effect of bird sounds showed that a total of 37% of respondents felt that the sound of birds had a high-stress restorative effect, 61% moderated, and only 2% rated it low.

3.3. Relationship of Stress Levels and Stress Restorative Effects of Bird Sounds

The results of the Pearson correlation analysis showed that there was a very low correlation

Table 3. Demographic characteristics of respondents

Variable	Category	Percentage (%)	Variable	Category	Percentage (%)
Gender	Male	28	Education level	Diploma	7
	Female	72		Bachelor	24
Age	14-18	16	Occupation	Student	12
	19-25	59		College student	38
	26-35	12		Civil servant	3
	>36	13		Private worker	14
Place of residence	Bogor City	14		Housewife	11
	Bogor Regency	52	Others	22	
	Other Cities	34	Income (rupiah)	<2.500.000	33
Education level	Elementary	4		2.500.001-5.000.000	42
	Middle school	10		5.000.001-7.500.000	14
	High school	55		7.500.001-10.000.000	6
				>10.000.000	5

Table 4. Visits characteristics of respondents

Variable	Category	Percentage (%)	Variable	Category	Percentage (%)
Frequency of visit	1 time	84	Travel time	30-45 minutes	22
	2-3 times	13		>45 minutes	55
	>3 times	3	Purpose of visit	Sports/health	17
Visit length	≤1 hour	12		Bird watching	2
	1-3 hours	55		View the collection of plants/monuments	6
	3-5 hours	24		Sightseeing/enjoy the view	50
	>5 hours	9		Spending time with family/friends	19
Travel time	<15 minute	4	School assignments	6	
	15-30 minutes	19	Bird enthusiast	Yes	24
		No		76	

Table 5. Frequency of stress levels based on restorative effect and interactions with birds

Stress level	Stress restorative effect			Total	Interaction with birds at KRB		Total
	Low	Moderate	High		Yes	No	
Low	1	8	13	22	1	6	22
Moderate	1	50	22	73	1	9	73
High	0	3	2	5	0	0	5
Total	2	61	37	100	2	15	100

between stress level and Stress restorative effects of bird sound. The correlation value being -0.03 showed a negative relationship between the respondent's stress level and the stress restorative effect of bird sounds, although it did not show a significant result (p-value = 0.767). This means that the lower a person's stress level, the higher the stress-restorative effect of bird sounds.

A frequency test was performed to explore the relationship between stress levels and the stress restorative effect of bird sounds, that can be seen in Table 5. Respondents with moderate to low-stress levels perceived stress restorative effect of bird sound higher than respondents with high-stress levels. The results also showed that there was an interaction between respondents with moderate to low-stress levels with birds in KRB, both visually and auditory, thereby increasing the stress restorative effect of bird sounds.

3.4. Respondents' Characteristics Affecting the Stress Restorative Effect of Bird Sounds

The stepwise linear regression analysis results showed that the variables that significantly affect the perceived stress restorative effect of bird sounds were age (p-value<0.01) and frequency of visits (p-value<0.05). According to Table 6, the intercept of the regression analysis also showed a significant result (p-value<0.001).

According to the percentage of sensitivity to birds by frequency of visits (Table 7), it can be seen that the more often respondents visit the Bogor Botanical Gardens, the more sensitive they are to the sound of birds.

The results of the Chi-square analysis did not show significant results in each of the variables tested, the test results can be seen in Table 8.

Table 6. Stepwise linear regression analysis of respondents' characteristics

Variable	Estimate	t-value	p-value
Intercept	59.7349	7.919	0.000***
Age	0.5214	2.653	0.00932**
Frequency of visits	8.3755	2.080	0.04015*

*p<0.05, **p<0.01, ***p<0.001

Table 7. Percentage of sensitivity to birds by frequency of visits

Sensitive to birds	Frequency of visits		
	1 time	2-3 times	>3 times
Yes	84.52	84.62	100
No	15.48	15.38	0

Table 8. Results from the Chi-square test

Variable	X-squared	p-value
Gender	2.13	0.3456
Occupation	16.94	0.075
Reason of visit	9.65	0.4713
Bird enthusiast	3.63	0.1625

4. Discussion

This study showed that 31% of respondents who felt the high-stress restorative effect of bird sounds had low-stress levels and 61% who felt moderate to low effect had higher stress levels. High-stress levels could be interpreted as a low psychological health condition and cause the perceived stress restorative effect of bird sounds to also be low. Thus, a person with a higher stress level might be suspected to have a low-stress restorative effect of bird sounds. This further supports the findings of this research about the inverse correlation between stress levels and the stress restorative effect of bird sounds, although the correlation was weak. This result was in line with Erfanian *et al.* (2021) which stated that

poor psychological health can inhibit a person's perception of natural sounds. This inhibition might be caused by an attenuated neural activation in areas of the auditory cortex leading to alternations in auditory processing, which might be suffered by people with low psychological health (Erfanian *et al.* 2018; Zwansger *et al.* 2012).

Based on the results of the regression analysis, age significantly affected a person's perception of the stress restorative effect of bird sounds, with older people tends to perceive bird sounds as restorative. This result imply that hearing bird sounds could reduce older people's stress. This result was in line with Hedblom *et al.* (2017), Liu *et al.* (2013), Liu *et al.* (2019) and Zhang and Kang (2007) which stated that older people tends to prefer natural sounds, specially bird sounds, when in parks or natural settings because bird sounds can make them feel calm. According to Hedblom *et al.* (2017) and Fang *et al.* (2021), the reason for this calming effect came from the strong connections felt by older people that might grow up in natural settings, which is linked to the theory of place identity or place attachment by Knez (2014) and Knez *et al.* (2018). In addition, the bird sounds that they heard might remind them of their pleasant experience or memories, which makes them feel calm. This result was in line with Ratcliffe *et al.* (2016), who stated that the restorative potential of birdsong was related to a person's memories or experiences, and Erfanian *et al.* (2021), who stated that age could potentially highlight the contextual role of the acoustic environment, in which experiences, memories, and even traumas give a particular context to our perception and shape the soundscape, making individual perception highly diverse, depending on the content of experience/memory. Jeon *et al.* (2021) also stated that individual traits based on acquired experience have a greater impact on the potential restorative effect of the urban soundscape.

This study also found that people with high sensitivity to bird (indicated by high interactivity with birds) tend to have a high perceived stress restorative effect of bird sounds. According to Liu *et al.* (2019), increased sensitivity to birds could be due to a person's high frequency of visits to a park, thus leading to high familiarity. Hedblom *et al.* (2017), Ratcliffe *et al.* (2020), and Fang *et al.* (2021) found that people with more experience and familiarity with the site related to sounds of nature tend to perceived bird sounds as restorative and felt calmer.

In this study, the majority of visitors were female. The same result was also found by Gaffar *et al.* (2018) and Affandi *et al.* (2020). Meng *et al.* (2008) explained that women tend to choose tourist attractions with natural nuances, which could provide a relaxation experience and a sense of security. The high number of college student respondents was suspected to be related to Gamayanti *et al.* (2018) and Ambarwati *et al.* (2019) which explained that college students, especially final-year students, tend to experience moderate to high levels of stress. Based on Hanai and Oguchi (2016), someone who experienced stress will tend to travel to reduce their stress. Aside from that, this research was conducted during the holiday season for college students, right before the start of the new semester, and thus contributed to the high number of college students. This result also coincided with the high number of young visitors (aged <25 years old), which according to Dinda and Ghosh (2021) tends to visit a park on holiday.

Visits characteristics consisted of frequency of visits, length of visit, travel time, and purpose of visits. A person's perceived recovery effect of a park might increase or decrease depending on their visit characteristics. Several studies showed that the longer length of visit (Carrus *et al.* 2015; Van den Berg *et al.* 2016; Xie *et al.* 2020) and high frequency of visits (Kim and Miller 2019) could increase the perceived restorative effect of the park. The longer someone stays and the more frequent visits to the park could increase the visitor's familiarity with said park and leads to a greater appreciation of their restorative qualities. Kim and Miller (2019) attributed this restorative effect to place attachment, the longer the duration of stay and the higher frequency of visits could make people more attached to the park, thus the higher restorative effect.

In conclusion, this study showed that most respondents had a moderate stress level, with the majority feeling moderate to high-stress restorative effects from bird sounds. From this study, we found that the lower the stress level, the higher the stress restorative effect from bird sounds felt by respondents, which further exploration showed that restorative stress effect of bird sounds was felt more by respondents with moderate to low-stress levels and less perceived by respondents with high-stress level. Age and frequency of visits to parks have been detected as factors that increase a person's perceived stress restorative effect of bird sounds. The variable of

age and frequency of visits were related to a person's experience and familiarity with the site of natural soundscape, in this case, Bogor Botanical Garden and bird sounds.

From this study, we felt that it is necessary to do research related to the maximum stress level, where the sound of birds can have a stress restorative effect and reduce a person's stress level. In addition, it is necessary to conduct research related to the sound of birds of the species found in the Bogor Botanical Gardens and the use of these bird sounds as a restorative therapy from the concept of forest healing, which can reduce a person's stress level in Indonesia.

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