



Original article

Addressing psychosocial issues caused by the COVID-19 lockdown: Can urban greeneries help?

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ABSTRACT

The Coronavirus disease-2019 (COVID-19) pandemic has affected over 200 countries, forcing governments to impose lockdowns to contain the spread of the disease. Although effective in reducing infection rates, the lockdowns have also resulted in a severe negative impact on mental health throughout the world; Setting the foundation for mental illnesses to become the next “silent” pandemic. This study attempts to determine a self-care method of ensuring mental health during the COVID-19 pandemic, especially for those living under lockdown. We evaluated the potential of physical exercise (in a nature setting) and nature therapy in improving mental wellbeing, among young adults with either stress, anxiety or depression symptoms. The study involved thirty subjects, who were equally divided into a nature-exercise group and a nature therapy group. The participants were briefed on the activities that they were to perform on a daily basis, and both groups performed their assigned activities concurrently for one week (27th April 2020 to 3rd May 2020) at urban greeneries accessible to them (rooftop parks, neighbourhood parks, home gardens). We used the depression, anxiety and stress scale – 21 items (DASS-21) to evaluate the mental health status of participants, once before beginning the study (baseline readings) and once at the end of the study (after a week of nature-exercise/nature therapy). There was a statistically significant reduction in stress, anxiety and depression symptoms for both the nature-exercise and nature therapy groups. However, when evaluating the effectiveness of exercise and nature therapy in treating stress, anxiety and depression symptoms on a case-by-case basis, it was discovered that nature therapy was more effective in treating mental health issues. Hence, nature therapy has the potential to be a form of preventive medicine, namely in preserving mental health during the COVID-19 crisis.

1. Introduction

The severe acute respiratory syndrome coronavirus 2 (COVID-19) outbreak occurred at Wuhan, China in December 2019 (Santarpia et al., 2020), and has now become a global pandemic (Wang et al., 2020). The total number of cases and deaths has far exceeded those of SARS, and as of September 2021, COVID-19 has killed more than 4.5 million people worldwide. Thus, it is no surprise that the World Health Organization (WHO) has declared the COVID-19 outbreak as “the highest level of emergency of international concern” (Cao et al., 2020).

1.1. Mental health during the COVID-19 outbreak

Pandemic outbreaks can have a negative impact on mental health, causing psychosis, anxiety, trauma, suicidal tendencies, chronic stress and panic (World Health Organization (WHO), 2020). Several studies have reaffirmed this with the COVID-19 pandemic (Kelly, 2020; Moghanibashi-Mansourieh, 2020; Rajkumar, 2020; Wang et al., 2020; Zhai and Du, 2020). The impact appears to be worse in regions under lockdown (Jankowicz, 2020), . The increased stress and anxiety levels caused by the outbreak have also been linked to an increase in domestic

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violence and child abuse worldwide (Taub, 2020). Therefore, there is a need for people to not only take precautions in avoiding COVID-19 infections, but to also take necessary measures in preserving mental health (Grover et al., 2020).

Malaysia is no exception when it comes to the negative impacts of lockdowns (NST, 2020a). Lockdowns and movement control orders have been largely successful in flattening the curve, however there has been several other setbacks (NST, 2020b). Malaysia is on the verge of experiencing its worst economic recession in history (Khalid, 2020), massive unemployment (Lim, 2020) and a growth in mental deterioration (Hassandarvish, 2020). Even before the pandemic, mental health issues in Malaysia had tripled in the past two decades, attributed largely due to a lack of awareness on mental health and also societal stigma pertaining to mental illnesses (Chua, 2020). With the pandemic outbreak and lockdowns in place, mental illnesses are set to become a “silent” pandemic in Malaysia (Hassandarvish, 2020).

Thus, there is an obvious need for a self-care method that will improve mental health during this pandemic, especially those living under lockdowns. The World Health Organization (World Health Organization (WHO), 2020) has listed several actions/activities that can be taken to preserve mental wellbeing during this pandemic, for example maintaining a daily routine, exercising, maintaining a healthy diet and keeping in regular contact with loved ones (via telephone, social media, etc.).

1.2. Nature therapy

Research has found that nature has the ability to improve mental wellbeing, in a process known as “nature therapy”. Nature therapy, sometimes referred to as ecotherapy, is a technique or treatment employed to improve an individual’s physical or mental health using natural surroundings. Nature therapy can be performed in any natural setting, including forests, oceans or even home gardens (Chevalier, 2012). There are mainly two forms of nature therapy. The first does not include certified professionals such as therapists and psychologists, but simply uses nature itself as a form of therapy (Bielinis et al., 2018; Furuyashiki et al., 2019). The second is an evidence-based practice that uses certified therapists or health specialists to improve physical and mental health by incorporating nature (Berger and Tiry, 2012; Sonntag-Öström et al., 2015; Dolling et al., 2017), and is often referred to as “forest therapy” (Rajoo et al., 2019). For this paper, we will refer to the first type as “nature therapy”, and the second type as “forest therapy”.

Despite numerous studies affirming the benefits of nature therapy in terms of improving general well-being (Rajoo et al., 2020), yet the exact mechanisms that allow for these benefits is still not fully understood (Franco et al., 2017). The general consensus is that urban settings overload human sensory with “polluted” senses, thus experiencing natural environments provide a calming and restorative effect (Ulrich et al., 1991). Therefore, the various activities performed in nature therapy focuses on experiencing nature through each of our senses (Franco et al., 2017).

For instance, nature therapy activities that focused on viewing natural landscapes have been found to have a calming effect (Franco et al., 2017; Rajoo et al., 2019), even reducing blood pressure of elderly hypertensive men (Song et al., 2017b). Nature sounds like birdsongs have also been used in nature therapy to relieve stress (Franco et al., 2017). Breathing exercises are commonly performed to encourage the participants to indulge in the “smell” of natural environments (Song et al., 2016). Elderly patients with chronic pulmonary diseases gained more health benefit from breathing exercises when performed in forests (Bing et al., 2016). This can be attributed to breathing in phytoncides, which are antimicrobial volatile organic compounds derived from trees, which improves immunity (Ohtsuka et al., 1998; Li et al., 2006). It has also been reported that psychiatric treatment for children was more effective when paired with nature therapy at a beach (Berger and Tiry, 2012). Activities performed in this study focused on “touch” sensory, whereby children played with sand and seawater while undergoing psychiatric therapy.

1.3. Study objective

This study attempts to determine a self-care method of ensuring mental health during the COVID-19 pandemic, using urban greeneries. We evaluated the potential of nature therapy and physical exercise in improving mental wellbeing, among young adults with either stress, anxiety or depression symptoms. This study aims to serve as a pilot study for future widescale research projects that can provide governmental agencies, mental health professionals and the general public an effective tool in safeguarding the mental wellbeing of society as a whole, in the face of the COVID-19 pandemic.

2. Material and methods

2.1. Study design, setting and participants

This study was approved by the University’s Ethic Committee for Research Involving Human Subjects. This research was considered to be a low risk research, whereby the Ethic Committee only raised anonymity as being a cause for concern. The study utilized anonymous online surveys, in all thirteen states and three federal territories of Malaysia. The survey was propagated using social media and their anonymity were ensured, by only using all data provided by the participants solely for this study. Any personal identifiers such as contact details were only used for direct communication pertaining to this study, and were deleted once the study was concluded. Other personal details that could reveal the identity of the participants were deleted at the conclusion of the study.

To obtain a homogenous group of participants, we focused on young adults (18–40 years old) that believed they were suffering from mental health issues as a direct result of the COVID-19 pandemic or the MCO. The initial survey was conducted on 19th April 2020 to 23rd April 2020, receiving 853 respondents, and we evaluated their mental health status. We used the depression, anxiety and stress scale – 21 items (DASS-21), which is a widely validated tool in evaluating the status of depression, anxiety and stress of subjects (Lovibond and Lovibond, 1995; Lee et al., 2020). Each parameter (depression, anxiety and stress) is evaluated separately in the questionnaire (seven items for each parameter), along with different scoring weightages for each parameter; Stress symptoms requires a score of ≥ 15 , for anxiety symptom ≥ 8 , and for depression symptom ≥ 10 (Lovibond and Lovibond, 1995).

Besides evaluating their mental health, the respondents were also asked demographic questions and also how often they followed-up on COVID-19 news. They were also asked the “zone level” at their place of residence. The Ministry of Health of Malaysia categorizes the severity of COVID-19 infection rates by zones; Green zones (no Covid-19 cases), yellow zones (1–20 cases), orange zones (21–40 cases), and red zones (41 cases and above). Red zones have more MCO restrictions in place, while green zones have more leeway.

Only 42 of the initial 853 respondents exhibited either stress, anxiety or depression symptoms. These 42 respondents also responded “none” to the statement “What steps do you take to maintain your mental health?”, indicating that they did not take any active measures to manage their mental health.

An invitation was extended to these 42 respondents to participate in this study on 24th April. Several subjects had to drop out of the study as they didn’t have access to urban greeneries or due to other personal issues that were not specified. The respondents were allowed to opt-out of the study without providing justification, in line with the university’s ethical committee’s guideline. Additionally, three more participants didn’t comply with the study protocols and were removed from the study. Thus, a total of thirty participants were recruited for this study. The thirty participants were split and assigned to their respective groups randomly; nature-exercise group and nature therapy group. Both the groups performed their preassigned activities at urban greeneries that were accessible to them; Rooftop parks, neighbourhood parks, home gardens.

Table 1

Descriptive statistics of baseline DASS-21 scores of participants, before the intervention study was conducted.

| Total (N = 30) | Mean | SD | Skewness | Kurtosis | Symptoms | |
|-------------------------------|-------|------|----------|----------|--------------|--------------|
| | | | | | Yes | No |
| Stress | 12.63 | 4.52 | 0.58 | 0.49 | 9 (30 %) | 21 (70 %) |
| Anxiety | 6.87 | 3.25 | 0.26 | 0.82 | 17 (56.67 %) | 13 (43.33 %) |
| Depression | 8.23 | 4.43 | 0.04 | 1.23 | 15 (50 %) | 15 (50 %) |
| Exercise group (N = 15) | | | | | | |
| Stress | 13.13 | 3.96 | 1.1 | 1.33 | 5 (33.33 %) | 10 (66.67 %) |
| Anxiety | 6.8 | 3.63 | 0.46 | 1.23 | 9 (60 %) | 6 (40 %) |
| Depression | 8.67 | 4.53 | 0.11 | 1.26 | 8 (53.33 %) | 7 (46.67 %) |
| Nature therapy group (N = 15) | | | | | | |
| Stress | 12.13 | 5.11 | 0.51 | 0.21 | 4 (26.67 %) | 11 (73.33 %) |
| Anxiety | 6.93 | 2.94 | 0.11 | 0.12 | 8 (53.33 %) | 7 (46.67 %) |
| Depression | 7.8 | 4.44 | 0.01 | 1.19 | 7 (46.67 %) | 8 (53.33 %) |

Participants were briefed on their respective activities via a PDF file attached to Google Docs, and were encouraged to ask questions regarding their responsibilities either via email or WhatsApp. Both groups performed their assigned activities daily and concurrently for one week (27th April 2020 to 3rd May 2020) for approximately twenty minutes. On 4th May, the participants' mental health status was evaluated once again, using the DASS-21.

For the nature-exercise group, we used a clinically proven exercise program that was especially designed for beginners to perform without any gym equipment (Kilka and Jordan, 2013). Each exercise in the circuit is performed for 30 s, with 10 s transition time between. Total time for entire circuit workout is approximately seven minutes. The twelve exercise were jumping jacks, wall sit, knee push-up (regular push-up for those who are able to), abdominal crunch, step-up onto chair, squat, triceps dip on chair, plank, running in place, lunge, knee push-up (push-up and rotation for those who are able to) and side plank. Participants either used YouTube or the Home Workout exercise app to guide them throughout the exercise program. Participants also did appropriate warm-up before exercising, and were reminded to not exert themselves.

For the nature therapy group, the participants performed three common nature therapy activities; Sensory enjoyment, stretching exercises and meditation (Song et al., 2016). These activities were selected as they had been found to be effective in a previous Malaysian forest therapy study (Rajoo et al., 2019). Sensory enjoyment consisted of engaging the senses with different natural aspects. This included visual stimuli performed by observing the natural environment in detail, smell by taking in deep breaths, sound by listening to natural sounds like birdsongs, and touch by feeling the soil and flora. For stretching exercises, participants performed basic stretches incorporating the neck, arms, lower back and legs. Participants were informed to not overdo the stretches beyond their physical limit. Meditation either involved deep breathing or reciting religious/spiritual mantras, which was performed according to the participant's personal preferences. Each activity was performed for five to seven minutes. The participants were briefed in detail on how to practice each activity, and were instructed to conduct the nature therapy program every morning, before the afternoon heat.

2.2. Data analysis method

The data were analysed using SPSS software version 25, for descriptive statistics and inferential statistics (chi-squared and dependent *t*-test). Besides statically analysing the results, we also compared the data based

Table 2

Relationship between baseline DASS-21 scores with COVID-19 variables, before the intervention study was conducted.

| | | Stress | Anxiety | Depression |
|-------------------------------|------------------|--------------|-------------|-------------|
| COVID-19 Zone level | Red | 21.75 ± 3.14 | 7.13 ± 5.28 | 8.5 ± 2.2 |
| | Orange | 17.24 ± 2.75 | 7.25 ± 3.41 | 8.63 ± 3.5 |
| | Yellow | 14.4 ± 3.74 | 6.5 ± 1.83 | 7.2 ± 4.8 |
| | Green | 8.96 ± 6.32 | 6.58 ± 2.74 | 4.84 ± 5.85 |
| | Chi-Squared test | 0.03* | 0.39 | 0.36 |
| Following-up on COVID-19 news | Very often | 12.81 ± 4.23 | 7.14 ± 4.85 | 7.5 ± 2.5 |
| | Somewhat often | 11.6 ± 2.34 | 6.61 ± 1.7 | 8.6 ± 1.96 |
| | Not very often | 11.82 ± 4.74 | 5.21 ± 2.69 | 7.63 ± 1.7 |
| | Never | – | – | – |
| | Chi-Squared test | 0.21 | 0.57 | 0.37 |

N = 30, M ± SD, **p* < 0.05.

on a case-by-case basis, that is whether the week-long exercise or nature therapy program was able to alleviate the individuals' stress, anxiety or depression symptoms.

3. Results

3.1. Research participants' demographic and baseline mental health status

As mentioned previously, a total of 30 participants were involved in this study, who were split evenly and assigned to their respective groups randomly; nature-exercise group (N = 15) and nature therapy group (N = 15). The participants were 26.2 ± 4.14 years old (20 males and 10 females). Table 1 shows the baseline mental health status of the respondents, that is their mental health status before the study was conducted. Of the thirty participants in this research, 30 % showed symptoms of stress, 56.67 % had symptoms of anxiety while 50 % had symptoms of depression. For the nature-exercise group, the majority exhibited symptoms of anxiety (N = 9) and depression (N = 8). While for the nature therapy group, a majority of the participants exhibited symptoms of anxiety (N = 7), seven participants had symptoms of depression while four had symptoms of stress.

3.2. Association between COVID-19 variable with mental health status

Table 2 shows the relationship between COVID-19 variables with mental health status of the participants, before conducting the study. Of the 30 study participants, four lived in red zones, five resided in orange zones, nine lived in yellow zones while the remaining twelve lived in green zones. More than 66 % of the participants followed COVID-19 related news very often (N = 11) or somewhat often (N = 9), while 33 % followed the news not very often (N = 10). None of the participants said that they never followed the news at all. Pearson Chi-Square analysis found no association between COVID-19 zone level with anxiety ($X^2(1, N = 30) = 37.64, p = 0.39$), and depression ($X^2(1, N = 30) = 45.07, p = 0.36$). Pearson Chi-Square analysis also found no association between following-up on COVID-19 news with stress ($X^2(1, N = 30) = 45.81, p = 0.21$), anxiety ($X^2(1, N = 30) = 22.23, p = 0.57$) and depression ($X^2(1, N = 30) = 29.94, p = 0.37$). However, Pearson Chi-Square analysis found an association between zone with stress ($X^2(1, N = 30) = 40.74, p = 0.03$), whereby participants in red zones recorded higher stress.

Table 3

Summarized effects of the nature-exercise program on DASS-21 scores of participants.

| | Baseline | After | t-test |
|------------|--------------|--------------|--------|
| Stress | 13.13 ± 3.96 | 11.27 ± 4.41 | 0.00* |
| Anxiety | 6.8 ± 3.63 | 5.27 ± 3.6 | 0.02* |
| Depression | 8.67 ± 4.53 | 7.2 ± 7.2 | 0.01* |

N = 15, M ± SD, *p < 0.05.

Table 4

Effects of the nature-exercise program on DASS-21 scores, by subject.

| | | Stress Symptoms | | | Anxiety Symptoms | | | Depression Symptoms | | |
|-------------|------------|-----------------|----------|-------------|------------------|----------|-------------|---------------------|----------|-------------|
| Subject | Gender/Age | Baseline | After | Improvement | Baseline | After | Improvement | Baseline | After | Improvement |
| Subject-E1 | Male, 21 | 23 (Yes) | 19 (Yes) | No | 11 (Yes) | 8 (Yes) | No | 11 (Yes) | 10 (Yes) | No |
| Subject-E2 | Female, 27 | 18 (Yes) | 18 (Yes) | No | 9 (Yes) | 7 (No) | Yes | 6 (No) | 5 (No) | – |
| Subject-E3 | Female, 32 | 16 (Yes) | 15 (Yes) | No | 12 (Yes) | 11 (Yes) | No | 9 (No) | 5 (No) | – |
| Subject-E4 | Male, 26 | 16 (Yes) | 12 (No) | Yes | 7 (No) | 5 (No) | – | 4 (No) | 4 (No) | – |
| Subject-E5 | Male, 20 | 14 (No) | 11 (No) | – | 8 (Yes) | 5 (No) | Yes | 4 (No) | 3 (No) | – |
| Subject-E6 | Male, 39 | 11 (No) | 9 (No) | – | 9 (Yes) | 4 (No) | Yes | 2 (No) | 3 (No) | – |
| Subject-E7 | Male, 27 | 11 (No) | 12 (No) | – | 4 (No) | 2 (No) | – | 16 (Yes) | 15 (Yes) | No |
| Subject-E8 | Female, 27 | 10 (No) | 9 (No) | – | 2 (No) | 1 (No) | – | 10 (Yes) | 8 (No) | Yes |
| Subject-E9 | Female, 23 | 9 (No) | 5 (No) | – | 2 (No) | 1 (No) | – | 13 (Yes) | 13 (Yes) | No |
| Subject-E10 | Male, 27 | 12 (No) | 14 (No) | – | 10 (Yes) | 8 (Yes) | No | 11 (Yes) | 10 (Yes) | No |
| Subject-E11 | Male, 28 | 10 (No) | 7 (No) | – | 8 (Yes) | 5 (No) | Yes | 5 (No) | 2 (No) | – |
| Subject-E12 | Male, 19 | 11 (No) | 9 (No) | – | 1 (No) | 1 (No) | – | 14 (Yes) | 8 (No) | Yes |
| Subject-E13 | Female, 27 | 13 (No) | 8 (No) | – | 2 (No) | 1 (No) | – | 13 (Yes) | 10 (Yes) | No |
| Subject-E14 | Female, 28 | 8 (No) | 5 (No) | – | 9 (Yes) | 10 (Yes) | No | 2 (No) | 1 (No) | – |
| Subject-E15 | Male, 30 | 15 (Yes) | 16 (Yes) | No | 8 (Yes) | 10 (Yes) | No | 10 (Yes) | 11 (Yes) | No |

Table 5

Summarized effects of nature therapy on DASS-21 scores of participants.

| | Baseline | After | t-test |
|------------|--------------|-------------|--------|
| Stress | 12.13 ± 5.11 | 7.67 ± 3.48 | 0.00* |
| Anxiety | 6.93 ± 2.94 | 4.8 ± 2.46 | 0.00* |
| Depression | 7.8 ± 4.44 | 4.53 ± 2.85 | 0.00* |

N = 15, M ± SD, *p < 0.05.

3.3. Effects of nature-exercise on mental health

Table 3 shows that there was a significant reduction in stress, anxiety and depression symptoms after the nature-exercise program. The stress levels of the participants reduced significantly after the nature-exercise program (M = 11.27, SD = ±4.41) when compared to the baseline readings before the nature-exercise program (M = 13.13, SD = ±3.96), (t(14) = 3.2, p < 0.001). Similarly, the anxiety baseline readings before the program (M = 6.8, SD = ±3.63) significantly reduced after the nature-exercise program (M = 5.27, SD = ±3.6), (t(14) = 3.1, p < 0.02).

Table 6

Effects of nature therapy on DASS-21 scores, by subject.

| | | Stress Symptoms | | | Anxiety Symptoms | | | Depression Symptoms | | |
|-------------|------------|-----------------|---------|-------------|------------------|---------|-------------|---------------------|----------|-------------|
| Subject | Gender/Age | Baseline | After | Improvement | Baseline | After | Improvement | Baseline | After | Improvement |
| Subject-N1 | Male, 33 | 18 (Yes) | 12 (No) | Yes | 8 (Yes) | 6 (No) | Yes | 3 (No) | 1 (No) | – |
| Subject-N2 | Male, 31 | 19 (Yes) | 12 (No) | Yes | 10 (Yes) | 7 (No) | Yes | 7 (No) | 4 (No) | – |
| Subject-N3 | Male, 19 | 23 (Yes) | 14 (No) | Yes | 13 (Yes) | 8 (Yes) | No | 5 (No) | 2 (No) | – |
| Subject-N4 | Male, 24 | 14 (No) | 9 (No) | – | 4 (No) | 2 (No) | – | 11 (Yes) | 8 (No) | Yes |
| Subject-N5 | Female, 24 | 12 (No) | 8 (No) | – | 3 (No) | 1 (No) | – | 10 (Yes) | 5 (No) | Yes |
| Subject-N6 | Female, 25 | 13 (No) | 9 (No) | – | 9 (Yes) | 7 (No) | Yes | 2 (No) | 2 (No) | – |
| Subject-N7 | Male, 28 | 9 (No) | 5 (No) | – | 2 (No) | 0 (No) | – | 10 (Yes) | 7 (No) | Yes |
| Subject-N8 | Male, 23 | 15 (Yes) | 11 (No) | Yes | 8 (Yes) | 5 (No) | Yes | 6 (No) | 3 (No) | – |
| Subject-N9 | Male, 27 | 11 (No) | 8 (No) | – | 6 (No) | 6 (No) | – | 7 (No) | 4 (No) | – |
| Subject-N10 | Female, 30 | 10 (No) | 6 (No) | – | 8 (Yes) | 4 (No) | Yes | 3 (No) | 1 (No) | – |
| Subject-N11 | Female, 28 | 11 (No) | 4 (No) | – | 9 (Yes) | 8 (Yes) | No | 15 (Yes) | 7 (No) | Yes |
| Subject-N12 | Male, 21 | 9 (No) | 5 (No) | – | 4 (No) | 4 (No) | – | 12 (Yes) | 4 (No) | Yes |
| Subject-N13 | Male, 19 | 4 (No) | 2 (No) | – | 5 (No) | 3 (No) | – | 14 (Yes) | 10 (Yes) | No |
| Subject-N14 | Male, 33 | 9 (No) | 5 (No) | – | 7 (No) | 5 (No) | – | 11 (Yes) | 8 (No) | Yes |
| Subject-N15 | Male, 30 | 5 (No) | 5 (No) | – | 8 (Yes) | 6 (No) | Yes | 1 (No) | 2 (No) | – |

The depression baseline readings before the program (M = 8.67, SD = ±4.53) significantly reduced after the nature-exercise program (M = 7.2, SD = ±7.2), (t(14) = 3.0, p < 0.01). However, the results weren't as promising when the effects of exercise were evaluated on a case-by-case basis (Table 4). Of the five subjects that exhibited stress symptoms, only one individual (Subject-E4) ceased to show stress symptoms after one-week of exercise. Nine participants had anxiety symptoms, but only four participants (Subject-E2, Subject-E5, Subject E-6 and Subject E-11) stopped showing anxiety symptoms, while out of the eight participants

that had depression symptoms, only two (Subject-E8 and Subject-E12) stopped showing depression symptoms.

3.4. Effects of nature therapy on mental health

Similar to the nature-exercise group, there was a significant reduction in stress, anxiety and depression symptoms after a week-long nature therapy program (Table 5). The stress levels of the participants reduced significantly after the nature therapy program (M = 7.67, SD = ±3.48) when compared to the baseline readings before the nature therapy program (M = 12.13, SD = ±5.11), (t(14) = 7.9, p < 0.001). Similarly, the anxiety baseline readings before the program (M = 6.3, SD = ±2.94) significantly reduced after the nature therapy program (M = 4.8, SD = ±2.46), (t(14) = 3.1, p < 0.001). The depression baseline readings before the program (M = 7.8, SD = ±4.44) significantly reduced after the nature therapy program (M = 4.53, SD = ±2.85), (t(14) = 5.2, p < 0.001). Moreover, unlike the nature-exercise group, the effects on an individual basis were also promising (Table 6). After nature therapy, all

four participants (Subject-N1, Subject-N2, Subject-N3 and Subject-N8) that had stress symptoms, showed no symptoms after nature therapy. Out of the eight participants that had anxiety symptoms, six participants (Subject-N1, Subject-N2, Subject-N6, Subject-N8, Subject-N10 and Subject-N15) ceased showing symptoms. Six out of the seven participants that had depression symptoms, stopped showing symptoms after nature therapy (Subject-N4, Subject-N5, Subject-N7, Subject-N11, Subject-N12 and Subject-N14).

4. Discussion

The purpose of this study was to determine a self-care method of ensuring mental health during the COVID-19 pandemic, using urban greeneries. We evaluated the potential of nature therapy and physical exercise (in a nature setting) in improving mental wellbeing, among young adults with either stress, anxiety or depression symptoms. Statistical analysis found an association between zone and stress, where residents of red zones were more likely to experience stress symptoms. Which is understandable since residents of red zones have more restrictions in place compared to other zones. Red zone inhabitants have their movement severely restricted via police roadblocks (they can only travel within 10 km for essential goods and services), have increased law enforcement surveillance and in some extreme cases, they are not even allowed to leave their homes for essential goods (food supplies are delivered directly to them). Thus, individuals under severe quarantine conditions are more at risk of mental health deterioration (Moghani-bashi-Mansourieh, 2020).

There was a significant reduction in stress, anxiety and depression symptoms for both the nature-exercise and nature therapy groups. However, everyone reacts differently to stressful situations, thus the key to effective mental health management is to ensure that the resources are appropriate to their needs (Reinhard, 2000; Arya, 2020). When evaluating the effectiveness of nature-exercise and nature therapy in treating stress, anxiety and depression symptoms on a case-by-case basis, it is apparent that nature therapy is more effective than exercise in treating mental health issues. As mentioned previously, studies have proven that nature therapy has a positive effect on human health, from both physiological and psychosocial perspectives. Moreover, nature therapy has also been found to be able to alleviate depression (Furuyashiki et al., 2019), manage stress for highly-stressed individuals (Dolling et al., 2017), and in treating patients with severe exhaustion disorders (Sonntag-Öström et al., 2015). Thus, in line with the findings of this study, nature therapy could be an effective tool in mental health management during the COVID-19 pandemic.

There has been much debate on why natural environments have a positive effect on mental and physical health (Rajoo et al., 2021). Some researchers believe that it is the activities performed in nature that brings benefit, and not nature itself. Therapeutic activities and light exercises like stretching exercises have been found to have a positive effect on the immune system (Smyth et al., 2002), blood glucose levels (Ohtsuka et al., 1998) and chronic stress reduction (Dolling et al., 2017). However, several studies that examined the effects of urban environments and natural environments on human health, discovered that the positive effects of relaxing activities and light exercises could only be experienced by participants in forest settings (Bing et al., 2016; Song et al., 2017b). Ulrich et al. (1991) proposed that living in structure-dominant environments would increase the stress levels of urbanites, causing them to be more susceptible to mental and physical illnesses. The Stress Reduction Theory (SRT) developed by Ulrich et al. (1991) explains the need for urbanites to experience natural elements at times. SRT states that by observing natural sceneries, such as greeneries and lakes, it creates positive feelings and emotions that enables a restorative effect. This theory isn't new. In ancient Rome, it was common for people to periodically take refuge in forested areas to deal with urban congestion (Glacken, 1967). Some researchers believe the healing powers of nature is primarily due to phytoncides, a volatile substance

emitted by plants Li et al. (2006). Song et al. (2016) discovered that indoor exposure to forest derived phytoncides could increase NK cell activity and improve overall immunity function. Hence, it is safe to conclude that the health benefits derived from nature therapy is due to a combination of relaxing activities, light exercises and the natural therapeutic atmosphere.

5. Conclusion

The core objective of this study was to serve as a pilot study for future widescale research projects that can provide key stakeholders and the general public an effective method to manage mental health, especially during the COVID-19 pandemic. This study found that both exercise and nature therapy when performed at urban greeneries, has the potential to be a form of preventive medicine, namely in preserving mental health during the COVID-19 crisis. In this regard, mental health professionals should advise the general public on the actions/activities that they can take to prevent mental health issues, especially for those under quarantine or lockdowns. For individuals with access to natural sceneries such as home gardens, nature therapy should be one of the activities performed on a daily basis.

This study has several limitations. Namely, the lack of a control group. This meant that other factors, such as time, could have improved mental health instead of the interventions. Other factors such as gender, age and type of greenery were also variables that can affect the outcome of the study, but could not be statistically analysed due to a small sample size. Thus, this pilot study is best used as a foundation for future research in this area. Future studies should involve a larger sample size, and use other evaluation tools besides DASS-21, including direct psychiatric evaluation. The potential for nature therapy to serve as a preventive medicine for individuals experiencing mental fatigue and work stress should also be evaluated. Appropriate governmental agencies should develop effective self-care nature therapy programs for the general public, allowing for the preservation and improvement of the mental wellbeing of society.

Author statement

Keeren Sundara Rajoo contributed to the conceptualization, methodology, interpretation of results and writing. Daljit Singh Karam contributed to the data acquisition, interpretation of results and writing. Arifin Abdu contributed to interpretation of results and writing. Zamri Rosli and Geoffery James Gurusu contributed to the writing (Review & Editing).

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Declaration of Competing Interest

None.

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