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PHYSIOLOGICAL AND PSYCHOLOGICAL HEALTH BENEFITS OF URBAN GREEN SPACE

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PHYSIOLOGICAL AND PSYCHOLOGICAL HEALTH BENEFITS OF URBAN GREEN SPACE

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This study explores the physiological and psychological effects of urban green space by using stress as a determinant of well-being. This study also aims to provide scientific evidence supporting the use of urban green space as a method to relieve stress. The subjects of this study were 20 male students which their homogeneity was controlled. The study area chosen for this study was Taman Botani Perdana, Kuala Lumpur and Jalan Bukit Bintang was used as a control area. The first day the participants went to Taman Botani Perdana and on the second day to Jalan Bukit Bintang. Participants were asked to walk along a given route in both areas in which the time was set similarly in both areas (20 minutes). Saliva samples were collected before and after walking in both areas along with blood pressure measurements. In addition, psychometric tests namely the Profile of Mood States (POMS), Positive and Negative Affect Schedule (PANAS), Perceived Stress Scale (PSS) and the Restoration Outcome Scale were done to identify the psychological effects of urban green space use. The results indicated that salivary cortisol concentration levels among participants in the urban green space is significantly lower than the participants in the city. Blood pressure readings also showed a significant decrease in value among participants in UGS for diastolic pressure. In the Restoration Outcome Scale (ROS), participants in the UGS setting reported a higher score for all six statements in the scale compared to the City setting with a significance of $p < 0.01$. The POMS test indicated a clear distinction between the restorative effects of urban green space and city as the Total Mood Disturbance (TMD) of participants in the urban green space showed negative in value while participants in the city showed positive TMD. Perceived Stress scores in the urban green space is significantly higher in mean value compared to the city setting in both before and after period. When summing the scores of positive and negative subscales of the PANAS test, a significant difference can be found at the city setting for both positive and negative subscales. Positive attitudes decreased while negative attitudes increased after walking in the city. In the UGS setting however, only positive attitudes increased.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

FAEDAH KESIHATAN FISIOLOGI DAN PSIKOLOGI KAWASAN HIJAU BANDAR

Oleh

MOHAMED DANIEL BIN MOHAMED MOKHTAR

Oktober 2017

Pengerusi : Nor Akmar Abdul Aziz, PhD
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Kajian ini meneroka kesan fisiologi dan psikologi kawasan hijau bandar dengan menggunakan tekanan (stress) sebagai penentu kesihatan. Kajian ini juga bertujuan untuk mengemukakan bukti saintifik yang menyokong penggunaan kawasan hijau bandar sebagai kaedah untuk mengurangkan tekanan. Subjek kajian ini adalah 20 pelajar lelaki yang dikendalikan secara homogen. Tempat yang dipilih untuk kajian ini ialah Taman Botani Perdana, Kuala Lumpur dan Jalan Bukit Bintang yang digunakan sebagai kawasan kawalan. Pada hari pertama peserta bergerak ke Taman Botani Perdana dan pada hari kedua ke Jalan Bukit Bintang. Peserta diminta untuk berjalan di sepanjang laluan yang ditetapkan di kedua-dua kawasan di mana masa ditetapkan sama dalam kedua-dua kawasan (20 minit). Sampel air liur dikumpulkan sebelum dan selepas berjalan di kedua-dua kawasan bersama dengan pembacaan tekanan darah. Di samping itu, ujian psikometrik iaitu Profil Keadaan Mood (POMS), Jadual Kesan Positif dan Negatif (PANAS), Skala Tekanan Dipahami (PSS) dan Skala Hasil Pemulihan (ROS) telah dilakukan untuk mengenal pasti kesan psikologi penggunaan ruang hijau bandar. Keputusan menunjukkan bahawa tahap kepekatan kortisol di kalangan peserta di ruang hijau bandar adalah jauh lebih rendah daripada peserta di bandar. Bacaan tekanan darah juga menunjukkan pegurangan nilai yang signifikan di kalangan peserta di UGS untuk tekanan diastolik. Hasil ujian Skala Output Pemulihan (ROS), peserta dalam kawasan hijau bandar melaporkan skor yang lebih tinggi untuk semua enam kenyataan pada skala berbanding dengan peserta di kawasan bandar dengan signifikan $p < 0.01$. Ujian POMS menunjukkan perbezaan yang jelas antara kesan pemulihan kawasan hijau bandar dan bandar kerana Jumlah Gangguan Mood (TMD) peserta di ruang hijau bandar menunjukkan nilai yang negatif manakala peserta di bandar menunjukkan nilai yang positif. Skor Tekanan yang dialami di kawasan hijau bandar jauh lebih tinggi dalam nilai min berbanding dengan bandar pada kedua-dua tempoh sebelum dan selepas. Dengan menjumlahkan skor subskala positif dan negatif ujian PANAS, perbezaan yang signifikan boleh didapati di kawasan bandar untuk kedua-dua

subskala positif dan negatif. Nilai min sikap positif menurun manakala sikap negatif meningkat selepas berjalan di bandar. Walaubagaimanapun, pada kawasan hijau bandar, hanya sikap positif yang meningkat.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Declaration by graduate student

I hereby confirm that:

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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

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LIST OF ABBREVIATIONS

ART	Attention Restoration Theory
EEG	Electroencephalogram
ELISA	Enzyme-linked immunosorbent assay
HPA	Hypothalamus-pituitary-adrenal activation
mmHg	Milimieters of mercury
nmol/l	Nanomoles per litre
PANAS	Positive and Negative Affect Schedule
POMS	Profile of Mood States
PSS	Perceived Stress Scale
ROS	Restoration Outcome Scale
TMD	Total mood disturbance
UGS	Urban green space

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Urban green space is defined as all publicly owned and publicly accessible open space with a high degree of cover by vegetation e.g. parks, woodlands, nature areas and other green spaces (Schipperijn et al., 2010). The use of urban green space is defined in general as any sort of visit to an urban green space, without looking at the duration of stay, the motivation of visit or the activity done; e.g. passing through on the way to a destination is also counted as use (Schipperijn et al., 2010). Any sort of interaction with an urban green space is considered as use as the many benefits of an urban green are passive or in other words intangible. These passive benefits are of or closely related to emotional or psychological responses of people. Chiesura (2004) states; despite their intangible and immaterial nature, these services (of urban parks) provide clear benefits to people, whose loss can have serious socio-economic consequences. Urban green space is often considered to be essential for urban dwellers as the benefits provided by them are extensive.

Green spaces within urban settings are believed to be experiencing pressures and threats as a result of urban growth. Therefore, there is a prevalent concern that urban sprawl and rapid expansion of cities occurring all over the globe can isolate urban dwellers from direct contact with nature (Willson, 1984). These concerns are more dominant in developing countries where cities lack proper development planning especially in terms of landscapes. The United Nations (UN) has estimated that more than 50% of the world's population are already living in urban areas and this percentage is forecasted to rise rapidly over the coming years (United Nations, 2014). This leads to more expansion of cities to provide housing, employment opportunities, roads and other infrastructures that may degrade the natural environment.

Willson's (1984) "biophillia" hypothesis states that humans possess a deep-seated biological need for connections and contact with nature, which can be understood as living systems other than that of human beings. This is where the role of urban green spaces comes into hand. As more areas are given way for urbanization and development, humans are starting to lose contact with nature. In addition, from a social and political context, the role of urban green spaces, particularly park and recreation settings, have also been related to other goals such as environmental preservation, community and economic development, rather than focused on public health.

In today's society, people are faced with work pressures, noise pollution, and other stressors particularly in urban areas. This phenomenon drives people to seek out relief and physical activity through outdoor recreation in restorative environments. Urban sprawl has also been linked directly to increment of obesity rates (Ewing et al., 2008). With obesity, risk of other diseases such as cardiovascular diseases, hypertension, diabetes and certain cancers increases many folds (Ramachandran & Snehalatha, 2010). For urbanites, urban green spaces provide the most ready access to restorative environments (Maller et al., 2006). Urban green spaces also act as a platform for people to exercise and be inspired to be more physically active. In an urban environment, the main contribution to the enhancement of quality of life in terms of perceived health conditions and environmental quality, as well as the affective and cognitive attachment to the place of residence, is thus provided by urban green spaces and their availability and accessibility (Conedera et al., 2015).

In spite of the recognised benefits of urban green spaces, the frequency of park use amongst Malaysians is still low (Malaysian Quality of Life, 2002). Only 20.2% of Malaysian families are engaged in recreation activities once a week; less than half of Malaysian families do so once a month. Most Malaysian cities lack a well-functioning green infrastructure; for example, poor accessibility to parks (National Urbanization Policy, 2006). According to a study by Sreetheran & Adnan (2007), Kuala Lumpur does not have a proper green network that links all existing open spaces. This is a problem, as accessibility and connectivity are important prerequisites for green space usage. Contrary to the belief that shade is much appreciated in a tropical hot climate, the availability of green space in large cities such as Kuala Lumpur is still lacking, thus, forcing people to stay indoors in air-conditioned rooms. This eventually would lead to low levels of physical activity which is one of the key reasons of the high obesity rate in the country. The boom in studies concerning physical activity fostered through urban green spaces and the built environment should be used as a basis to develop urban green spaces in large cities of Malaysia such as Penang and Johor Bahru.

Moreover, Malaysia is well known as a multi-racial nation consisting of various different races and ethnic groups such as Malay, Indian, Chinese, Kadazan, Iban, and Dayak. Previous studies for instance by Nor Akmar (2012) reported different use patterns of users depending on their demographic profile. For example, Malay users and Indian users reported different levels of usage of urban green spaces and also different use patterns. However, the studies on urban green space use in Malaysia also have little objective data on physical health as most of the studies use self-reported data.

1.2 Problem Statement

Urban green space such as parks are underutilized and somewhat neglected by Malaysians. With the low frequency of park users, it is difficult to justify the existence and the need to have an urban park. Hence, by studying the

physiological and psychological restorative outcomes of urban green space through objective data and self-reported data accentuates the importance of it.

Existing studies on the restorative effects of urban green spaces have been extensive throughout the years. However, there is little objective or experimental data that could further provide solid backing in regard to the physical health of an individual after using urban green spaces. Most research on physical health benefits in the best only studied on self-reported data (Nor Akmar et al. 2012; Schipperijn, 2010; Pietila et al., 2015). The hypothesis of psycho-physiological benefits of natural environments has only hardly faced experimental tests (Hartig et al., 2003). (Bell et al., 2008) has also stated that only limited numbers of studies use objective measurements such as blood pressure monitoring, to assess physical health benefits. Majority of other studies utilize self-reported data.

Although it has been hypothesized by many researchers that level of physical activity increases well-being, there is no clear indication as how beneficial physical activity in urban green spaces is based on objective data as it is lacking. The gap in this knowledge needs to be addressed to better understand the benefits of urban green spaces which may be useful in public health and urban green space planning and management. Furthermore, regional studies on stress levels has always been limited to questionnaires whether in the form of open-ended questions or ratings and scales. While subjective ratings on stress may be viable, experimental tests on stress needs to be done in order to provide solid objective data. Therefore, a common biomarker for stress i.e., cortisol, must be measured to further understand the physiological effects of urban green space.

In addition, in order to objectively understand whether urban green space or natural environments (e.g. a park) has more benefits physiologically and psychologically, research needs to be done on the difference between engaging in the same physical activity in a natural environment and a more built or in other words, synthetic environment such as the city. With the aforementioned issues, the following research questions can be forwarded;

1. Is there any difference between walking in the city and walking in an urban park physiologically?
2. What are the perceived stress and other psychological parameters experienced by users in both city and urban park settings?

1.3 Objective

The main objective of this experimental research is to discover whether use of urban green space affaects physical health based on objective measurements

and also how it affects mental health and well-being by comparing it with the environment of a city. In order to meet this aim, the following research objectives were formulated;

1. To determine the stress levels of users by measuring salivary cortisol concentration.
2. To explore the effect of urban green space on blood pressure reading of users.
3. To identify the restorative psychological effects of urban green space on users.

1.4 Significance of the Study

The results of this study could provide insight in the health promotion that urban green space offers. In light of the urbanization phenomenon that is occurring in Malaysia, stress, which is a well-known determinant of health, and its relation to use of urban green space can be further examined. The results would also justify on the need on preserving urban green spaces, particularly urban parks, as it is the easiest form of natural environment access for urbanites. In a broader and general outlook, this study is in line with the Malaysian National Landscape Policy (2010), which strives for developing urban landscapes that is conducive and healthy for the nation. This study's results could also be beneficial in the field of environmental psychology which plays a big role in helping urbanites' mental well-being.

1.5 Limitation of the Study

Due to a limited budget and a complex field study design, this study utilizes a small sample (N=20) in which the participants are controlled. The participants consist of male students of a similar age range and from the same course to ensure consistent background and IQ level. The age of the participants were in average 23.1 years old. Female samples were excluded as other outlying variables will need to be considered particularly menstrual cycle stages. Therefore, the results of this study is much more suitable to be extrapolated to young adult males.

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