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The Relationship between Physical Activity in a Natural Environment and Symptoms of Anxiety and Depressive Disorders: A Cross-Sectional Study Among University Students[1]

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Abstract

Mental health is a raising concern globally. Anxiety disorders and depression dominate among all mental health problems. Previous studies have shown that physical activity, especially when done in an outdoor natural setting, may have a positive impact on improving mental health including depression and anxiety symptoms. This descriptive correlational study was conducted at Asia-Pacific International University, Thailand to investigate the relationship between physical activity in a natural environment and the occurrence of depressive and anxiety disorder symptoms. In the study conducted, a cross-sectional design was used involving a total of 62 online students who participated in a survey in the midst of the COVID-19 pandemic. The results indicated a high prevalence of depressive (67.2%) and anxiety (77%) symptoms ranging from mild to extremely severe. The data were analyzed using Pearson's correlation. The results showed a weak but insignificant negative ($r = -0.157$) correlation between physical activity in a natural environment and anxiety symptoms, and a weak but insignificant positive ($r = 0.134$) correlation between physical activity in a natural environment and depressive symptoms.

Keywords: *Natural environment, physical activity, anxiety, depression*

Introduction

Mental health problems are now a rising public health concern worldwide. In 2017, it was estimated that 792 million people were living with a mental health disorder, which was around one in 10 globally (10.7%) (Dattani et al., 2021). Mental health problems are the single largest cause of disabilities worldwide, and some of the major disabilities are depression, anxiety, dementia, and alcohol abuse (Pan American Health Organization, 2019). Among these, depression and anxiety disorders dominated (Dattani et al., 2021). Depression is a worldwide illness and is also a major contributor to the total global burden of disease. It is estimated that 5% of adults are affected by depression (World Health Organization, 2021). And around 19.1% of the U.S.A. population aged 18 and above are affected by anxiety disorders every year (Anxiety and Depression Association of America, 2022).

The outbreak of the COVID-19 pandemic placed people under widespread emotional distress, particularly those with anxiety and/or depressive disorders. A nationwide survey in China in 2020 found that the implementation of unprecedented strict quarantine measures had triggered a series of psychological disorders, such as panic disorder, anxiety, and depression (Qiu et al., 2020). Panchal et al. (2021) pointed out that the average percentage of adults in the U.S.A. reporting anxiety or depressive disorder symptom greatly increased from 11.0% in 2019 to 41.1% by January 2021.

Literature Review

Good mental health is defined as "a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, work productively and contribute to his or her community" (World Health Organization, 2018, para 1). Moreover, depression and anxiety were among the top 10 causes of disability-adjusted life-years among 10–24-year-olds in 2019 (GBD 2019 Diseases and Injuries Collaborators, 2020). As the most prevalent mental disorder, depression is defined as "a mood disorder that causes a persistent feeling of sadness and loss of interest" (Mayo

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Clinic, 2023, para. 1). Anxiety refers to an emotion identified by tense feelings, worried thoughts, and physical changes like sweating, trembling, and dizziness (American Psychological Association, 2022). Anxiety and depression often occur concurrently and sequentially in children and adolescents (Garber & Weersing, 2011).

Growing evidence suggests that physical activity acts as a protective factor against mental health symptoms among children and adolescents. It protects against emergence of depression regardless of age or geographical region, and decreases anxiety symptoms in people with a current diagnosis of anxiety and/or stress-related disorders (Oliva et al., 2021; Schuch et al., 2018; Stubbs et al., 2017). Chekroud et al. (2018) looked at the association between physical exercise and mental health in 1.2 million individuals in the USA. They found that all types of exercise were associated with a lower mental health burden than no exercise. The most significant associations with mental health were found in popular team sports, cycling, aerobic, and gym activities, with durations of 45 mins, and frequencies of three to five times per week. Grasdalsmoen et al. (2020) examined associations between the frequency, intensity, and duration of physical exercise and mental health problems among university students. They found that psychological distress and depressive disorders were negatively associated with physical activity; the more frequent, intense, and longer the duration, the less psychological distress and depressive disorders were reported.

Besides exercise, undertaking such activity in a natural environment has been shown to be more effective in improving mental health problems than if exercise is completed indoors. Mitchell (2013) concluded that physical activity in natural environments was associated with reducing poor mental health more than physical activity in other environments. Lawton et al. (2017) found that people who engaged in outdoor physical activity reported higher nature connective experiences and lower somatic anxiety levels. These findings were also reflected in Howell and Passmore's (2013) research, where they found affiliation with nature impacts people's physical health and overall well-being positively. Affiliation with nature impacts people's physical health and overall well-being positively. According to Hossain et al. (2020), exposure to a natural environment improved depressive symptoms, anxiety, and mood disorders. In addition, exposure to nature increased positive emotions and the ability to reflect on a life problem (Mayer et al., 2009). A study by Beyer et al. (2014) showed that higher levels of neighborhood green space were significantly associated with lower levels of depression, anxiety, and stress symptoms. A recent study also showed that contact with nature provided positive well-being effects, helped to maintain mental health, and had the potential for boosting resilience to environmental stressors, including those associated with COVID-19 (Samuelsson et al., 2020).

Research Objective

Asia-Pacific International University (AIU) campus, located in Muak Lek, Thailand, is surrounded by rolling hills and tree-lined pathways, with green lawns and many flowering plants. A football field, tennis courts, badminton courts, basketball courts, and on campus exercise room are available for students to use. However, all sports facilities were closed and group sports were prohibited during the pandemic at the time that this study was conducted. Students could only exercise inside their own rooms or individually on campus. The aim of this study was to find out if there was a relationship between physical activity in a natural environment and depressive and anxiety symptoms among the students at the University.

Research Questions and Alternative Hypotheses

1. Q 1: Is physical activity in a natural environment correlated with depressive symptoms among students at Asia-Pacific International University?

   H_1: Physical activity in a natural environment is correlated at a statistically significant level with depressive symptoms among students at Asia-Pacific International University.

2. Q 2: Is physical activity in a natural environment correlated with anxiety symptoms among students at Asia-Pacific International University?

   H_2: Physical activity in a natural environment is correlated at a statistically significant level with anxiety symptoms among students at Asia-Pacific International University.

Methodology

Study Design and Setting

This study was a quantitative, cross-sectional, and correlational study conducted during the COVID-19 pandemic at the Muak Lek AIU Campus in Saraburi Province, Thailand. The study population consisted of around 300 English speaking students at the University who lived on campus during the pandemic. Students who spoke English but lived in the community, and those who were Thai speaking and lived on campus were excluded. Participants voluntarily filled in a questionnaire about their physical activity and depression and anxiety symptoms during the previous seven days. Snowball sampling was used when distributing the questionnaires.

Instruments/Measures

The questionnaire used in this study was adapted from the Depression Anxiety Stress Scale-21 (DASS-21) (University of Wisconsin-Madison, 2023) and the International Physical Activity Questionnaire (IPAQ) short version (IPAQ, 2012). DASS-21 is a short version of a self-reported instrument designed to measure depression, anxiety, and stress. Questions related to stress were removed since it was not the focus of this study. It does not require training to administer this questionnaire; it targets participants aged 17 and above, and may also be used with individuals in clinical settings or in a research study (NovoPsych, 2021). IPAQ is a well-developed instrument that can be used internationally. It accesses respondents' vigorous, moderate physical activity, and walking in the past week. In this study, these questions were divided into two sections that accessed participants' indoor and outdoor physical activity (IPAQ, 2012). Both questionnaires are in the public domain, and required no permission for use.

To access both students' indoor and outdoor physical activity levels, questions such as "During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?" from IPAQ were split into two questions "During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling (indoors)?" and "During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling (outdoors)?"

Data Collection

Before starting data collection, the proposal was sent to the AIU Research Office for approval. After receiving approval at the end of January 2022, data collection started at the end of March and ended in the first week of April. This questionnaire was developed using a Google form and was distributed to each dormitory Messenger group and to students at the library. Later, snowball sampling was used to send the questionnaire to students individually through Messenger to get more students to participate.

After the Google forms were distributed to individuals on Messenger, a mistake was pointed out by one participant. The question "During the last 7 days, on how many days did you do vigorous physical activities like heave [*sic*] lifting, digging, aerobics, or fast bicycling?" from IPAQ were supposed to be split into two questions asking about both indoor and outdoor vigorous physical activity separately. However, in the online questionnaire that was sent to the students, only indoor exercise was mentioned and outdoor was missing. Therefore, almost 20 responses couldn't be used for the correlation analysis of outdoor exercise. Besides, participants were expected to give specific times in answering questions like "How much time did you usually spend doing vigorous physical activity?" and so responses with words or phrases like "not sure," "7 days," or "very few times" were removed. In the end, 35 responses remained and were used to do the analysis.

Ethical Considerations

An explanatory document about the survey and informed consent was provided to participants. Those who consented were asked to complete the anonymous, self-reported questionnaire.

Data Analysis

Data analysis was conducted using the Statistical Package for the Social Sciences. Descriptive statistics was used to examine the prevalence of depressive anxiety symptoms and physical activity levels. Pearson's correlation was performed to analyze the linear relationship between physical activities indoors and outdoors with depressive and anxiety symptoms.

Results

A total of 63 responses were received. One respondent filled in only demographic data; therefore, this response was removed from the data set. The remaining 62 responses were analyzed.

The youngest of the respondents was 19 years old, and the oldest was 32. Gender was almost evenly distributed at 46.8% and 53.2% male and female, respectively. Most of the respondents were Seventh- day Adventist Christians (83.6%), followed by Buddhists (8.2%), Baptists (6.6%), and other religions (1.6%). The distribution among the faculties from most to least were Arts and Humanities (22.6%), Education (22.6%), Religious Studies (21.0%), Business Administration (8.1%), Information Technology (8.1%), and Nursing (1.6%).

Prevalence of Physical Activity and Depressive Anxiety Symptoms

Responses were used to analyze the prevalence of physical activity and depressive anxiety symptoms and for the correlation analysis. The prevalence of normal, moderate, and high physical activity levels were 37.1%, 42.9%, and 20.0%, respectively.

Table 1 shows the prevalence of reported normal, mild, moderate, severe, extremely severe anxiety symptoms. The highest level of anxiety was found in the extremely severe category accounting for just over a third of participants. Around three quarters of the study population showed anxiety symptoms. Normal depressive symptoms were reported in just under a third of participants. Mild, moderate, severe, extremely severe depressive symptoms essentially were equally represented among the categories. It was clearly apparent that depressive symptoms were a predominant feature among the individuals surveyed in the study group.

Table 1 *Prevalence of Anxiety and Depressive Symptoms*

Feature	Normal	Mild	Moderate	Severe	Extremely Severe
Anxiety Symptoms	23.0%	11.5%	19.7%	11.5%	34.4%
Depressive Symptoms	32.8%	13.1%	19.7%	18.0%	16.4%

Correlation between Physical Activity in a Natural Environment and Depressive Anxiety Symptoms

Pearson's correlation was used to analyze the correlation between physical activity in natural environments (referred to as "outdoor") and depressive and anxiety symptoms, and between indoor physical activity and depressive and anxiety symptoms. The correlation between outdoor physical activity and anxiety is shown in Table 2.

Table 2 *Correlation Between Outdoor Physical Activity and Anxiety Symptoms*

Feature	Statistics	Anxiety	MET Category Outdoor
MET Category Outdoor	Pearson Correlation	-.157	1
	Sig. (2-tailed)	.367	
	N	35	35

The analysis revealed a weak and statistically insignificant negative correlation of -.157 (p = .367) between outdoor physical activity and anxiety symptoms. However, the trend shown was that the more outdoor physical activity that was reported, the less self-reported anxiety symptoms were recorded.

The correlation between outdoor physical activity and depression is shown in Table 3. A weak and statistically insignificant positive correlation of .134 (p = .443) was found between outdoor physical activity and depressive symptoms. The more outdoor physical activity that took place, the trend was for more depressive symptoms to be reported.

Table 3 *Correlation Between Outdoor Physical Activity and Depressive Symptoms*

Feature	Statistics	MET Category Outdoor	Depression
MET Category Outdoor	Pearson Correlation	1	.134
	Sig. (2-tailed)		.443
	N	35	35

The correlation between indoor physical activity and anxiety is shown in Table 4.

Table 4 *Correlation Between Indoor Physical Activity and Anxiety Symptoms*

Feature	Statistics	Anxiety	MET Category Indoor
MET Category Indoor	Pearson Correlation	.064	1
	Sig. (2-tailed)	.715	
	N	35	35

Analysis of data given in Table 4 showed no statistically significant correlation (p = .715) between indoor physical activity and anxiety symptoms. A similar result was found between indoor physical activity and depression, i.e., no statistically significant correlation (p = .773) was shown. These data gave no indication that indoor physical activity influenced either anxiety or depression.

Discussion

The results from this study indicated a high prevalence of depressive (67.2%) and anxiety (77%) symptoms regardless of the severity level. The majority of the respondents (62.9%) reported they had a moderate or high level of physical activity. The high prevalence of depressive and anxiety symptoms could be explained by both Norton's findings (2007) where he showed that Asians reported higher DASS-21 scores than other racial groups such as Africans, Caucasians, and Hispanic/Latinos and the impact of the COVID-19 restrictions which limited socializing.

Results also showed no correlation between indoor physical activity and depressive anxiety symptoms. A weak negative correlation was found between outdoor physical activity and anxiety symptoms. A weak positive correlation was found between outdoor physical activity and depressive symptoms. A study by Taniguchi et al. (2022) indicated that exposure to sunlight is one important factor that has a positive impact on people's mental health, including depression. Students at AIU tend to exercise in the evening, rather than in the morning or during the daytime. Their exercise, presumed to have been taken during the evening and in the absence of companionship, may have been responsible for the unexpected trend observed. Chekroud et al. (2018) found that compared with other exercise types, popular team sports showed the largest associations with lower mental health burdens. Missing elements such as sunshine and social activity during the pandemic period might explain the positive correlation trend between outdoor physical activity and depressive symptoms.

Results on the correlation between outdoor physical activity and anxiety agreed with Lawton et al.'s (2017) study. People who engaged in outdoor physical activity reported significantly lower somatic anxiety levels. Mitchell's study (2013) showed that regular use of natural environments was associated with a lower risk of poor mental health. However, no association dealing with depression and the exercise in the natural environment was examined in Mitchell's study. The results obtained in our study suggested that the effect of physical exercise in a natural environment on depressive

symptoms could merit further examination if a similar stressful episode occurred in the future. However, gathering data from a much larger sample size would be merited.

Limitations

There were several limitations encountered in this study, the biggest of which was the small sample size used. The survey instruments were used directly without considering the primary language of respondents. Allowance for the participation of the potential Thai cohort of students by having a Thai translation of the questionnaire would have been beneficial. Greater clarity regarding how much time the respondents spent on vigorous physical activity in the past week would have been beneficial together with an indication of the time of day that the activity occurred. Respondents were expected to answer how many minutes or hours they exercised. Instead, some respondents reported one to two times, and were therefore removed from the data analysis. A mistake in one question was found at an early stage of the questionnaire distribution, and so some responses obtained before fixing this error could not be included in the analysis. If a pilot study had been carried out before actual research, this problem could probably have been avoided.

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