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Effect of Physical Exercise on Depression in Patients at Surakarta Mental Hospital

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The high prevalence of depressive mental disorder along with its serious impacts requires a comprehensive treatment with pharmacological and non-pharmacological approaches. Physical exercise as a method of non-pharmacological therapy has been shown to be beneficial for the prevention and the cure of diseases. The purpose of this study was to determine the effect of physical exercise on the level of depression in patients with mild and moderate depression in Surakarta Mental Hospital. This study was an experimental study. The results showed that overall exercise had a significant influence on the decrease in the level of depression (t = 7.375, p = .002). However, physical exercise did not have a significant effect on reducing depression levels in the group of mild depression (t = 1.858, p = .529). Several limitations of this study may lead to the results of this study were not entirely as hypothesized.

Keywords: depression, physical exercise, mental hospital

Prevalensi gangguan jiwa depresi yang tinggi serta disertai dampak yang serius memerlukan penanganan komprehensif secara farmakologis maupun non farmakologis. Latihan fisik sebagai salah satu metode terapi non farmakologis, terbukti telah memberikan manfaat yang besar bagi pencegahan dan penyembuhan penyakit. Tujuan penelitian ini adalah menguji pengaruh latihan fisik terhadap tingkat depresi pada pasien dengan tingkat depresi ringan dan sedang di Rumah Sakit Jiwa Daerah Surakarta. Jenis penelitian ini adalah eksperimen. Hasil penelitian menunjukkan bahwa secara keseluruhan latihan fisik memberikan pengaruh yang signifikan pada penurunan tingkat depresi (t = 7.375, p = .002). Namun demikian, latihan fisik tidak memberikan pengaruh yang signifikan bagi penurunan tingkat depresi pada kelompok depresi ringan (t = 1858, p = .529). Beberapa keterbatasan dalam penelitian ditengarai mempengaruhi hasil dalam penelitian ini sehingga tidak sesuai dengan hipotesis yang diajukan.

Kata kunci: depresi, latihan fisik, rumah sakit jiwa

Depression is a mental health issue that deserves serious attention. Prevalence of depression in world population reached 3%-8%, with 50% of cases occur in the productive age of 20-50 years. Depression became one of the causes of disability in the world. WHO projects that by 2020 depression will occupy the second position as the global disease burden (WHO, 2012).

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Depression is generally defined as feeling sad, unhappy, unsuccessful, and despair that can be experienced by everyone at some period in his life (NIMH, 2012). However, the understanding of depression in clinical sense also involves a disruption of the brain that lasts for two weeks or more and disrupts the daily lives of individuals, such as the ability to work, sleep, and even an affinity for eating (APA, 2012).

According to the Diagnostic and Statistical Manual of Mental Disorders IV (APA, 1994), depressive disorders are divided into major depressive disorder, dysthymic

disorder, and depressive disorder not otherwise specified. Major depressive disorder is characterized by the presence of one or more major depressive episodes, which lasted at least two weeks and includes five or more symptoms of depression. The symptoms are: (1) the presence of depressed mood, which is a daily occurrence and indicated with feeling sad or empty and can be observed (crying), (2) loss of interest or pleasure in the sense of activity, (3) significant weight loss despite not on a diet, or weight gain, or changes in appetite, (4) insomnia or hypersomnia, (5) agitation or psychomotor retardation, (6) fatigue or loss of energy, (7) feeling of worthlessness or inappropriate guilt, (8) loss of the ability to think or concentrate, (9) thinking about death or recurrent suicidal ideas. Dysthymic disorder is characterized by depressed mood often suffered for over two years and has symptoms of depression that do not meet criteria for major depressive episode. Depressive disorder not otherwise specified is a form of depression that does not meet criteria for major depressive disorder and dysthymic disorder.

Criteria for depressive symptoms are varied, ranging from feeling sad all day, losing interest in activities, difficulty in thinking and concentrating, sleep disturbances, and significant weight loss (APA, 2012). In the most severe symptoms, depression can lead to suicidal behavior (APA, 2012). According to WHO data, 850 thousand cases of suicide in the world were associated with depression (WHO, 2012). In Indonesia, suspected cases of suicide due to depression are quite a lot. In Buleleng, the number of suicides found due to depression was 21 cases from January to October 2011 (Media Indonesia, 2012).

In all cases, depression led to the decline of functional abilities of patients, such as motivation to perform self-care or other daily activities and work productivity. In addition, people with depression tend to withdraw from social interaction, and avoid responsibilities and roles that should be done within the family and society (Maramis, 1994; Duncan, 2005).

Treatment of depression has been done using variety of approaches, including pharmacological and nonpharmacologic approaches. Nonpharmacologic approach includes interpersonal psychotherapy, cognitive-behavioral therapy, marital and family therapy, as well as the selection of specific therapies such as the provision of activities that can improve the functional capacity of the patient (Loosen et al, 2000).

Occupational therapy approach emphasizes the biopsychosocial process using sports or physical exercise to improve health (Duncan, 2005). Physical exercise is a type of physical activity which is carried out with a clear structure, and involves repeated body movements to improve or maintain physical fitness (ACSM, 2010).

According to the American College of Sports Medicine (2010), physical exercises include aerobic exercise, strength/resistance exercise, and flexibility exercises. Aerobic exercise is an exercise that involves large muscles of the body, which is done dynamically, rhythmic, and repetitive low-to-high intensity for a certain time. The purpose of aerobic exercise is to improve the work of the heart, blood vessels, and lungs. It include activities such as walking, jogging, running, cycling, swimming, rope jumping, and running up and down stairs. Strength exercise by providing resistance (resistance exercise) aims to improve the strength and endurance of specific muscle groups, as well as increasing bone density. This is done by providing resistance or load on the muscle groups and musculoskeletal which will be trained repeatedly with a certain frequency. The resistance could be its own body weight, or a weight machine and free weights such as barbell or dumbbell.

Examples of strength exercise include push-ups, sit-ups, squats, squat-stand, biceps curl, and weightlifting. Flexibility exercises are useful to maintain joint motion for moving in full range of motion without any limitations. This exercise is also often recommended as a warm up before starting another exercise to prepare the joints and muscles to prevent injury. Flexibility exercises also can include muscle and joint stretching, yoga, or tai-chi.

Many literatures have revealed that physical exercise can provide substantial benefits to health. This activity also plays a big role in the process of healing and recovery from disease (Powers & Howley, 2001). This is possible due to the physical exercise that causes physiological changes that positively affect the body, such as repairing the work of the heart, improving blood flow, controlling blood sugar levels, increasing muscle strength and endurance (Wilmore, Castill, & Kenney, 2008). In addition to the physical benefits, physical exercise also plays a major role in mental health. Physical exercise can reduce stress and fatigue, increase motivation, and provide a sense of achievement, increase excitement and better social life (Mental Health Foundation, 2012).

The purpose of this study is to determine the effect of physical exercise on depression, in patients with mild and moderate depression level. The hypothesis of this study was there is an effect of physical exercise on depression in patients with mild and moderate depression level.

This study can contribute to the treatment of depression. Most of the experimental studies that have been conducted and related to physical exercise for patients

with depression only applied single type of exercise, namely aerobic exercise. Aerobic exercise is a dynamic exercise, which requires individuals to keep moving for a certain period of time. For individuals suffering from depression as well as professionals who deal with people with depression, this can be a problem, because most people with depression are resistant to move, especially if they have to move constantly. It may reduce the effectiveness of aerobic exercise. This study applies a model of dynamic aerobic exercise combined with resistance training and stretching. Thus it can accommodate individuals with depression that tends to resist moving. In addition, these exercise movements are easily imitated, without special equipment, does not require specific rules, and can be done in a relatively short time, so it is considered appropriate to be trained to depressed individuals who generally had trouble in thinking/concentrating, and often feel tired easily.

Method

The study was conducted in experimental design, by providing treatment to determine the cause and effect of the studied variables (Sugiyono, 2004). This study took place at the Surakarta Mental Hospital.

The population of this study was patients with depressive symptoms who were treated in Surakarta Mental Hospital. The characteristics of the sample were (a) had mild or moderate depressive symptoms based on results of the BDI, (b) get a rehabilitation program, (c) has a good orientation on places, people, time, (d) understand Bahasa Indonesia (Indonesian language) as well as being able to read, (e) not having vision and hearing problems, (f) do not experience muscle and joint problems that cause limitation of motion, (g) the amount of sample was limited to 30 people.

The treatments were exercise consisting of aerobic exercise, strength/resistance exercise, and flexibility exercises. These three kinds of exercises are combined in a structured form of physical exercise. Physical exercise was done in less than 30 minutes per session for eight sessions of therapy. Because of the rules on limitation of staying in the hospital, then an increase in the frequency of the treatments was rescheduled. Physical exercise was originally planned two times a week for four weeks. However this was changed to three to four times a week to adjust schedules of the weekly activities in Surakarta Mental Hospital.

Implementation of the treatment was done by modelling, in which the therapist gave examples of each movement first and then imitated by the subjects. When demonstrating the movement, the therapist also explained verbally about the benefits of these movements in order to motivate subjects to perform. Each movement was done in accordance with the frequency defined in the module.

The instrument used was the Beck Depression Inventory (BDI). This instrument was developed by Aaron T. Beck in 1961 which was later adapted in 1969. This instrument aims to detect, inspect, and monitor changes in depressive symptoms in individuals who received treatment at a mental health institution, as well as to detect symptoms of depression in primary care institutions.

BDI consists of 21 items of questions, each of which has four responses. Each response has a value in the range of zero to three, indicating the degree of severity of symptoms. This instrument contains self-statements. The questions in the BDI examine mood, level of pessimism, sense of failure, self-dissatisfaction, feeling of guilt, self-dislike, self-accusation, suicidal ideation, weight loss, and loss of libido. Questions 1 through 13 examine psychological symptoms, while 14 to 21 questions examining physical symptoms.

BDI total score indicates the severity of depression. For the general population, a score of 21 or more indicates depression. As for the individual who has been clinically diagnosed with depression, a score of 0 to 9 = minimal symptoms of depression, 10 to 16 = mild depression, 17 to 29 = moderate depression, and 30 to 63 = severe depression (Polgar, 2012).

BDI has been extensively studied for content validity, concurrent validity, and construct validity. BDI has content validity because it was constructed from a consensus among clinicians about symptoms of depression in indicated psychiatric patients. At least 35 studies have shown the existence of concurrent validity between the BDI and other depression instruments examiners, such as Hamilton Depression Scale and the Minnesota Multiphasic Personality Inventory-D. Tests for construct validity also showed that BDI scores associated with medical symptoms, anxiety, stress, loneliness, sleep patterns, alcoholism, suicidal behavior, and adjustment among young people. Reliability of the BDI has also been carried out by following standard psychological tests published in 1985. High internal consistency reliability has been shown in more than 25 studies on different populations (Polgar, 2012).

The instrument used in this study was the BDI II, as the revised BDI in 1996. This instrument was translated by the authors into Indonesian language. The reliability based on Cronbach Alpha showed .84

Table 1
Subject's Characteristics

Subject's Characteristics (*n*=30)	Min	Max	Average	*SD*	Freq	%
Age	19	50	32	8.33		
Gender						
Man					24	80.00
Woman					6	20.00
Hospital's Room						
Ayodya					3	10.00
Abimanyu					8	26.66
Pringgodani					5	16.66
Sena					4	13.33
Maespati					4	13.33
Srikandi					4	13.33
Shinta					2	6.66

Tabel 2
The BDI score before treatment

Subject's Characteristics (*n*=30)	Min	Max	Average	*SD*	Freq	%
BDI score	10	28	22	5.34	30	100.00
Level of depression						
Mild	10	16	13.20	2.58	5	16.66
Moderate	17	28	23.76	3.74	25	83.33

Tabel 3
The BDI score after treatment

BDI score	Min	Max	Average	*SD*	Freq	%
BDI Score	0	33	13.23	7.56	30	100.00
Level of Depression						
Minimal	0	9	5.63	3.43	11	36.66
Mild	12	16	14.62	1.40	8	26.66
Moderate	17	23	19.1	1.92	10	33.33
Severe	-	33	33	0	1	3.33

and was considered to be a good enough reliability considering to Gable (1986) that affective instruments frequently report reliabilities as low as .70.

The examples of the items of BDI are shown below.

1. Sadness
   0. I do not feel sad.
   1. I feel sad much of time.
   2. I am sad all the time.
   3. I am so sad or unhappy that I can't stand it.
7. Self-dislike
   0. I feel the same about myself as ever.
   1. I have lost confidence in myself.
   2. I am disappointed in myself.
   3. I dislike myself.
15. Loss of energy
   0. I have as much energy as ever.
   1. I have less energy than I used to have.
   2. I don't have enough energy to do very much.
   3. I don't have enough energy to do anything.
19. Concentration difficulty
   0. I can concentrate as well as ever.
   1. I can't concentrate as well as usual.
   2. It's hard to keep my mind on anything for very long.
   3. I find I can't concentrate on anything.

Data collected in this study were obtained directly from patients through Beck Depression Inventory (BDI) assessment, which were performed before and after the physical exercise intervention. Data were analyzed using independent t-test, which was used to look for differences in the two groups which were associated,

in this case the group of patients with mild and moderate depressive symptoms, before and after the treatment (pre test - post test).

Subjects

Based on the criteria of the subjects, the authors found a total of 30 respondents aged between 19 and 50 years, with an average of 32 years old (24 men and six women). Thus the ratio of respondent's men to women was 4:1. Table 1 shows the characteristics of the subjects in this study.

Respondents in this study were patients with depressive disorder not otherwise specified. The majority of them receive care at the Mental Hospital not due to their depressive symptoms, but because of other mental disorder diagnoses, such as schizophrenia. Therefore, most of those patients do not get medications associated with symptoms of depression.

Results

Based on the examination of the BDI, the average score before treatment was 22, the lowest score was 10 and the highest score was 28. From these scores, there were 5 subjects (16.66%) with mild depression category with an average score of 13.20, while 25 subjects (83.33%) are included in the category of moderate depression, with an average score of 23.76. Table 2 shows the BDI score before treatment.

Measurements using the BDI then performed after subjects receive treatment. Table 3 shows the BDI score after the treatment.

Based on the analysis of the paired *t*-test on all samples regardless of the category of depression, at a significance level of $\alpha = .05$ with 29 degrees of freedom, the *t* value obtained was 7.375. *T* value was greater than *t* table (2.045). Thus it can be concluded that there was a statistically significant difference before and after the treatment. However, there are differences in the statistical analysis if the sample were divided by category of depression. In samples with mild depression category, the results showed no significant difference ($p = .529$, $t = 1.858 < t$ table 2.776). These results are in contrast to the moderate depression which showed a significant difference between before and after the treatment ($p = .023$, $t = 7.317 > t$ table = 2.064).

Results of statistical analysis on the mild depression group showed no significant difference in BDI scores before and after treatment. However, the results of the calculation of effect size indicate $r = .56$. According to Cohen (as cited in Myers & Hansen, 2006), $r > .5$ is considered a large effect.

Discussion

The results of this study indicate that in general, physical exercise has a positive effect to decrease depression. Some of the threats to internal validity according to Myers & Hansen (2006) have also been addressed. Instead of depressive disorder, the reason for most of the subjects' admission into the hospital were psychotic symptoms. Therefore, they generally do not receive treatments for depression. The only treatment for depression given to them was the physical exercise conducted on this study. This condition is expected to cope with the problem of the history of experiment as Myers & Hansen (2006) said that some outside event that occurred before the intervention could influence responses of the subject. Implementation of physical exercise as an intervention in this study was relatively brief, only eight therapy sessions for about two weeks. This was expected to minimize the possibility of changes in BDI scores due to the maturity of the individual. BDI has never been used before to examine patients in the rehabilitation unit at Surakarta Mental Hospital, so the respondents were not familiar with it. In addition, since the respondents have mental disorders other than depression, it may affects their ability to think and understand the BDI questions. Therefore, clear explanations were given when the respondents fill the instrument before and after the intervention. It can reduce the bias because of the instrument. Besides, BDI has been found to have a good reliability in this study.

Some of the studies that have been done before also support similar conclusions. A study conducted by researchers from UT Southwestern (2002) showed similar results with the results of this study. The study was conducted during July 1998 to October 2001. Subjects were 80 people with mild and moderate symptoms of depression. They were divided into three treatment groups, namely: moderate intensity aerobic, low intensity aerobic and flexibility exercises (stretching) for 15-20 minutes. After 12 weeks, the results showed that all groups showed a decrease in depressive symptoms with different weights. The first group had 47% reduction in depression, the second group 30%, while the third group 29%.

In the study conducted by Blumenthal in 1999, 156 subjects with major depression were divided into three

groups: aerobic exercise group, a group of anti depressant medication (sertraline), and the combination of both. The three groups received the intervention for four months. The most rapid decrease in depression effects was seen in the medication group, however, after four months there were no differences among the three groups associated with depressive symptoms.

Furthermore it was found that the degree of depression and the recurrence rate in the aerobic exercise group was lower than the other two groups. This was revealed by monitoring the respondents during six months after the study and found that 133 respondents, mostly from the aerobic group less frequently relapse (Pedersen & Saltin, 2006; Harvard Health Publications, 2012). A meta-analysis conducted in 2001 of the 14 trials also found that physical exercise significantly reduced symptoms of depression. Depression was measured using the Beck Depression Inventory (Lawlor & Hopker in Pedersen & Saltin, 2006). Physical Activity Guidelines Advisory Committee (PAGAC) in the United States has conducted research on various scientific journals published from 1995 to 2007 related to physical exercise and depression. They found that of 17 Random Clinical Trials, 12 of which reported a significant decrease in the level of depression, while the results of three non-RCT showed a significant decrease in depression (PAGAC Report, 2010).

Results of the statistical analysis on the mild depression group showed no difference in BDI scores before and after treatment. However, the result of the calculation of effect size indicates a large effect, which means that there is a large difference between the two conditions. It is possible that the small number of subjects, which is only five people, become a problem in this case; it is associated with the statistical analysis which is generally based on large sample size.

The magnitude of the effect size in this study was also supported by the results of previous studies. A study conducted by North (as cited in Strohle, 2009) about the effect of exercise on depression reported an effect size of .53. Larger effect size was shown in the study conducted by the Craft & Landers with patients diagnosed with major depression (as cited in Strohle, 2009) which reported an effect size of .72. This is in line with the results of the meta-analysis conducted during 1990 to 1997 which concluded that the effects of physical exercise will be more clearly seen in individuals with moderate to severe depression category (Landers, 2000). Blumenthal also found that physical exercise (aerobic) is as effective as antidepressant medication in reducing depression in subjects with major depression (Pedersen & Saltin, 2006).

In this study, the effect caused by physical exercise on depression was categorized at a medium level. This is possible because of the frequency, duration, and intensity of physical exercise was not optimal. The strength of the effect can be enhanced by providing more frequent physical exercise and in longer term. Limitation of hospitalisation in Surakarta Mental Hospital caused the physical exercise can only be given in about two weeks. In addition, the provision of treatment should also be tailored to the activity in the rehabilitation unit, so it was not possible to do it everyday. Provision of training duration, frequency, and high-intensity exercise seems to give a significant effect on the level of depression. It was also revealed in the five meta-analyzes that were conducted during 1990 to 1997. The conclusion of the meta-analysis was that physical exercise can reduce the symptoms of depression and anxiety and improve mood. Greater effect would be produced if the exercise conducted over nine weeks with a longer exercise duration and higher intensity (Landers, 2000).

The analysis of several factors may reveal a variety of possible causes of decline in depressive symptoms through physical exercise. The movement of the body in physical exercise stimulates the release of the hormone norephinephrine and ephinephrine also known as cathecolamines. Plasma concentrations of these two hormones were increased if the intensity of individual physical exercise also increases. Some of the effects caused by the release of this hormone include increased heart rate and respiration, increased blood pressure and the body's metabolic rate which all serve to improve mood and increase the body's energy (Wilmore, Costill, & Kenney, 2008; Harvard Health Publications, 2012).

Another theory that may explain the cause of the depression is the monoamine hypothesis, which states that depression is caused due to an insufficiency of monoaminergic neuronal activity. Insufficiency in activities undertaken by the neurotransmitter can cause lethargy depression (Carlson, 1988). Changes in body position and movement will trigger neurotransmitter activity of the norephinephrine thereby reducing the symptoms of depression.

Another mechanism that may explain the effect of physical exercise on depression is the endorphin theory. Physical exercise can increase endorphin activity, enzymes that circulate throughout the body. Increased endorphin will strengthen the body's natural immunity and reduce the perception of pain, which indirectly improve mood and encourage the activity of the body (Harvard Health Publications, 2012).

Psychologically, the ability to show the desired movements during exercise will improve the confidence and self-esteem which ultimately affects the mood. In addition, physical exercise done regularly can improve the quantity and quality of sleep that affects the body's energy and activity. Regular physical exercise can also help in the recovery to psychological stressors which improves depressive symptoms more quickly (Landers, 2000).

Limitations of this study include Beck Depression Inventory instrument that has not been recognized by the subjects, while they were required to answer each question independently. This can lead to misperceptions of the questions. In addition, this study did not use a control group for comparison. The absence of a control group makes the results of this study be interpreted with caution.

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