Effects of Exercise for Depression

Rebecca Gleason

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EFFECTS OF EXERCISE FOR DEPRESSION

By
Rebecca Gleason

A Senior Paper Submitted to the
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EFFECTS OF EXERCISE FOR DEPRESSION

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Senior Paper Advisor

Chairman of Health, Leisure and Sports Sciences Department

Defense Committee Member
Abstract


The purpose of this study was to examine the effects of exercise for adolescents, middle-aged adults, and older adults with depression.

Literature from thirty-four professional medical journals and eight professional websites were reviewed. The resulting information was organized into categories as described in the purpose of the study.

In 2017, it was estimated that 17.3 million adults living in the United States had at least one major depressive episode, which came to be 7.1% of all adults (DBSA, 2019). In a 2019 review, causes of depression were related to personal factors, some being personality, drug or alcohol use, family history, or a serious medical illness. With the example of personality, this can be a depressive trigger if it causes them to have a low self-esteem or worry a lot (Beyond Blue, 2019). Exercise causes the body to release growth factors and endorphins, which results in new connections being made and nerve cell growth. This improvement in brain function helps someone feel better (HHP, 2018).

A study found that an exercise intervention helped in reducing symptoms of depression by studying 18 adolescents. Dopp’s results showed a 19.9-point decrease in the exercise intervention group compared to a 2.8-point decrease in the treatment-as-usual group from before and after the study, respectively (Dopp, 2018). Carter studied 87 adolescents and found that circuit training and body-weight exercises helped in lowering depression levels (Carter, et al., 2015).

Morres concluded that the input of exercise resulted in lower levels of depression, with a change from 17.10 to 2.92 pre- and post-intervention of exercise (Morres, et al., 2019). In
Werneck’s study, 59,401 Brazilian adults were studied. He found that when physical activity recommendations were not met, depression scores were higher, whereas when recommendations were met, the average score was lower. This allowed him to conclude that meeting the recommended physical activity levels reduced depression scores (Werneck, et al., 2019). In a similar study, McDowell measured levels of depression of 10,000 adults and found that meeting the PA guidelines was directly correlated with 44.7% lower odds of elevated depressive symptoms (McDowell, et al., 2018). In another study, Danielsson studied 13 people diagnosed with Major Depressive Disorder (MDD) and found that by using aerobic exercise as an intervention, depression scores decreased from before to after the intervention with average scores of 23 to 12, respectively (Danielsson, et al., 2016).

In another study Ortiz concluded that consistent exercise reduced depressive symptoms in institutionalized older adults with the input of chair exercises across a span of 12 weeks (Ortiz, et al., 2019). Also, Jin looked at the effects of a long-term exercise intervention on depressive symptoms in 30 older Korean women and found that the average score decreased from 8.7 to 6.5. It could be seen that body fat and waist circumference also decreased with the input of exercise (Jin, et al., 2019).
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Chapter 1

Introduction

In the United States, depression is one of the most prevalent mental disorders. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) classifies depression as a loss of pleasure or interest in daily activities lasting at least two weeks that puts someone in a depressed mood and has problems with eating, energy, sleep, self-worth, and concentration (NIH 2019). It is a significant contributor to the overall global burden of disease and is considered the leading cause of worldwide disability (DBSA, 2019).

In 2017, it was estimated that about 7.1% of adults living in the U.S. had at least one major depressive episode, which represented 17.3 million adults. When it comes to depressive episodes causing severe impairment, about 4.5% of all adults living in the United States that were 18 years or older had at least one major depressive episode with severe impairment. This was equal to 11 million adults. The commonness of major depressive episodes was lower in males (5.3%) compared to females (8.7%). The age that depressive episodes were most often seen were in individuals aged 18-25 (13.1%) (NIH 2019). For children ages 3-17, 1.9 million were diagnosed with depression in 2018. 7 million adults aged 65 or older are also affected by depression (DBSA, 2019).

Depression is often connected to other illnesses and medical conditions such as cancer, strokes, heart attacks, coronary artery disease, HIV, Parkinson’s disease, eating disorders, substance use, diabetes, and polycystic ovary syndrome. It is also closely related to suicide, causing over two-thirds of the reported suicides each year (DBSA, 2019).

Research has shown that exercise can be an effective treatment when relating to lower symptoms of depression. Exercise has been proven to start a biological process of events that
eventually result in health benefits. Some benefits include improved sleep, lower blood pressure, and lower risks for heart disease and diabetes. Exercise causes the body to release endorphins and growth factors, which results in nerve cell growth and new connections. This improvement in brain function helps someone feel better. It has been seen in people with depression that the hippocampus is smaller. When these new connections form due to exercise, the hippocampus increases in size because of the nerve cell growth, which ultimately improves nerve cell connections and relieves depression (HHP, 2018).

Since depression causes high levels of physical pain, this can cause people to be less motivated to exercise. To get up and exercise after not doing it for long periods of time is very difficult to do, but that is why Dr. Miller suggests starting with as little as five minutes. Eventually, five minutes will turn into ten, and then ten will turn into more. Dr. Miller also said it is very important to remember that “the key is to make it something you like and something that you’ll want to keep doing,” (HHP, 2018).

Statement of the Problem
The purpose of this study was to examine the effects of exercise for depression.

Significance of the Study
It is important to increase the levels of physical activity in patients with depression because the number of children, adults, and older adults that deal with depression continues to increase each year (NIH, 2019). Having an inactive lifestyle increases the likelihood of depression, which in turn, increases the probability of having many medical conditions such as cancer, strokes, and heart attacks (DBSA, 2019).

Hypothesis
It was hypothesized that exercise could provide lower levels of depression in those
developing or showing signs and symptoms of depression.

Limitations and Delimitations

The information and materials gathered for this study were acquired from various databases available to Oral Roberts University. This study was limited in that it had to be completed within the course’s allotted time frame. This study relied on other professional studies and focused on the role of exercise for people with depression and its impact on the levels of signs and symptoms.

Definition of Terms

American College of Sport Medicine (ACSM)- an organization that promotes and integrates scientific research, education, and practical applications of sports medicine and exercise science to maintain and enhance physical performance, fitness, health, and quality of life (Medical Dictionary, 2014)

Beck Depression Inventory (BDI)- a standardized psychiatric questionnaire in which the subject rates each statement on a sliding scale and the responses are used to diagnose and determine the severity of depression (Webster’s, 2019)

Center for Epidemiologic Studies Depression Scale for Children (CES-DC)- a 20-item self-report that measures depression levels and is widely used (Very Well Mind, 2018)

Children’s Depressive Inventory (CDI-2)- a tool that mental health professionals use to measure the cognitive, affective, and behavioral signs of depression in children and adolescents between the ages of 7 and 17 (Very Well Mind, 2019)

Children’s Depression Rating Scale-Revised (CDRS-R)- a brief rating scale based on a semi-structured interview with the child; designed for 6- to 12-year-olds (and successfully used with adolescents), and can be administered in just 15 to 20 minutes and easily scored in a few minutes
Cognitive Behavioral Therapy (CBT) - psychotherapy that combines cognitive therapy with behavior therapy by identifying faulty or maladaptive patterns of thinking, emotional response, or behavior and substituting them with desirable patterns of thinking, emotional response, or behavior (Webster’s, 2019)

Cycle Ergometer - an apparatus for measuring the work performed (as by a person exercising) also: an exercise machine equipped with an ergometer (Webster’s, 2019)

Depression, Anxiety, Stress scale (DASS-21) - a set of three self-report scales designed to measure the negative emotional states of depression, anxiety and stress; constructed not merely as another set of scales to measure conventionally defined emotional states, but to further the process of defining, understanding, and measuring the ubiquitous and clinically significant emotional states usually described as depression, anxiety and stress (PSY, 2018)

Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) - a system of classification, published by the American Psychiatric Association, which divides recognized mental disorders into clearly defined categories based on sets of objective criteria; widely recognized as a diagnostic standard and widely used for reporting, coding, and statistical purposes (Medical Dictionary, 2012)

Exercise Motivation Inventory 2 (EMI-2) - a factorial valid means of assessing a broad range of exercise participation motives in adult males and females, applicable to both exercisers and non-exercisers (Markland, 2011)

Endorphins - any of a group of endogenous peptides (as encephalin and dimorphic) found especially in the brain that bind chiefly to opiate receptors and produce some of the same pharmacological effects (as pain relief) as those of opiates (Webster’s, 2019)
General Health Questionnaire-12 (GHQ-12)- a widely used screening instrument for detecting psychological strain in the general population (Markland, 2004)

Global Physical Activity Questionnaire (GPAQ)- was developed by WHO for physical activity surveillance in countries; collects information on physical activity participation in three settings (or domains) and sedentary behavior; domains include activity at work, travel to and from places, and recreational activities (World Health Organization, 2019)

Hamilton Depression Rating Scale (HAMD)- a list of specific symptoms used as a measure of severity of depression (Medical Dictionary, 2012)

Hemodialysis- the use of principles of dialysis for removal of certain elements from the blood while it is being circulated outside the body in a hemodialyzer or through the peritoneal cavity; procedure is used to remove toxic wastes from the blood of a patient with acute or chronic renal failure; also called dialysis, kidney dialysis, and renal dialysis (Medical Dictionary, 2012)

Hospital Anxiety and Depression Scale (HADS-D)- a self-assessment scale has been developed and found to be a reliable instrument for detecting states of depression and anxiety in the setting of an hospital medical outpatient clinic (Markland, 2019)

Hypertension- abnormally high blood pressure and especially arterial blood pressure (Webster’s, 2019)

International Physical Activity Questionnaire (IPAQ)- assesses the types of intensity of physical activity and sitting time that people do as part of their daily lives; considered to estimate total physical activity in MET-min/week and time spent sitting (Craig, 2016)

Interpersonal Therapy (IPT)- psychotherapy that focuses on a patient's interpersonal relationships and that is used specially to treat depression (Webster’s, 2019)

Montgomery–Åsberg Depression Rating Scale (MADRS)- a widely used clinician-rated
measure of depressive severity (Markland, 2013)

**Patient Health Questionnaire-9 (PHQ-9)**- the most common depression screening tool; indicates whether an individual has symptoms of depression that may require professional intervention (Very Well Mind, 2018)

**Physical Activity Vital Signs Questionnaire (PAVS)**- two questions are self-reported: 1) “How many days during the past week have you performed physical activity where your heart beats faster and your breathing is harder than normal for 30 minutes or more?” and 2) “How many days in a typical week do you perform activity such as this?” The responses are reported as days during the past week over days in a typical week, with scores ranging from 0 to 7 for each question; requires less than 30 seconds to administer and score (CDC, 2017)

**Postnatal Depression**- a mood disorder that begins after childbirth and usually lasts beyond six weeks; difficulty coping and can have effects on the baby, other children her partner, and other relationships (Medical Dictionary, 2019)

**Prone Position**- having the front or ventral surface downward (Webster’s, 2019)

**Psychodynamic Therapy**- the psychology of mental or emotional forces or processes developing especially in early childhood and their effects on behavior and mental states (Webster’s, 2019)

**Psychotherapy**- treatment of mental or emotional disorder or of related bodily ills by psychological means (Webster’s, 2019)

**Quick Inventory of Depressive Symptomology (QIDS-SR)**- a self-administered report that is used as a way of determining a patient’s level of depression before, during, and after treatment (Psych Congress, 2019)

**Rapid Assessment of Physical Activity (RAPA)**- a valid tool for use in clinical practice to
provide an easily administered and interpreted means of assessing levels of physical activity among adults older than 50 years (Markland, 2017)

**Selective Serotonin Reuptake Inhibitors (SSRIs)** - any of a class of antidepressants (such as fluoxetine) that inhibit the inactivation of serotonin by blocking its reuptake by presynaptic neuron endings (Webster’s, 2019)

**Serotonin and Norepinephrine Reuptake Inhibitors (SNRIs)** - an antidepressant medication (such as duloxetine or venlafaxine) that elevates mood by blocking neurons from taking up both norepinephrine and serotonin; combined reuptake inhibitors differ from medications such as sertraline or fluoxetine, which are relatively selective serotonin reuptake inhibitors, and from tricyclic antidepressants, which primarily prevent the reuptake of norepinephrine by brain cells; treat neuropathic pain as well as depression (Medical Dictionary, 2009)

**Social Support Questionnaire (SSQ)** - a 27-item questionnaire designed to measure perceptions of social support and satisfaction with that social support; each item is a question that solicits a two-part answer: Part 1 asks participants to list all the people that fit the description of the question, and Part 2 asks participants to indicate how satisfied they are, in general, with these people (Sarason, 2019)

**Sprint Interval Training (SIT)** - an effective and time-efficient training regimen to improve the performance of aerobic and anaerobic exercises; causes greater improvements in anaerobic exercise performance compared with that under normoxia (Markland, 2019)

**Supine Position** - lying on the back or with the face upward (Webster’s, 2019)

**Triaxial Accelerometer Devices** - three-dimensional devices that obtain accelerations during physical activities with a sensor built into a plastic case without a liquid crystal display; was designed to be clipped to a waist belt (Markland, 2015)
Chapter 2

Introduction

Chapter two is a summary of the effects of exercise for depression. This summary is organized into the following subdivisions: 1.) Causes of and types of treatment for depression, 2.) Exercise and depression for adolescents, 3.) Exercise and depression for middle-aged adults, and 4.) Exercise and depression for older adults.

Causes of and Types of Treatment for Depression

Beyond Blue commented on causes of depression being related to personal factors. Some of the factors they mentioned were personality, drug and alcohol use, family history, or a serious medical illness. If someone’s personality causes them to have a low self-esteem or worry a lot, that can be a trigger for depression. Some people have a high genetic risk for depression if their family had a history of going through it. Beyond Blue also points out that dealing with a chronic pain or disease can be a large factor when it comes to being diagnosed with depression (Beyond Blue, 2019). Also, NHS commented on a variety of causes of depression. They mentioned that there is usually an event or something that happened in a person’s life that sparks depression, and then life starts to look like it is moving in a downward spiral. Some specific causes that NHS mentioned were job loss, illness, giving birth, or loneliness. One’s depression levels can increase if the person is not in contact with friends or family. Postnatal depression is also a very common cause that can happen as the result of physical changes, hormonal changes, and the responsibility of taking care of a new baby (NHS, 2019). Further, Gregory commented on causes of depression for women. She noted that depression is twice as likely to affect women than it does men. Some of the factors that she says may be the cause of this include social pressures unique to a woman’s life experiences, a differing female response to stress, and reproductive hormones. She also
pointed out that hormonal imbalance can cause women to have problems with pregnancy or menstrual cycles, so this could also be a cause of depression (Gregory, 2019). Also, Harvard Health Publishing (HHP) commented on what may be causing depression. They noted that the brain has an impact on depression, and certain areas help in regulating mood. Nerve cell connections and growths are constantly happening in the brain. HHP also mentions the impact of genetic vulnerability when it comes to depression. When it comes to genes, there are some that turn on and others that turn off, and because of this, depression can be common in families because of genetics (HHP, 2019).

The National Alliance on Mental Illness (NAMI) commented on a couple types of treatment people tend to pursue for depression. They noted that psychotherapy and medications give people results they are looking for. Psychotherapy is talk therapy with a therapist, and the three types that NAMI mentioned were cognitive behavioral therapy (CBT), interpersonal therapy (IPT), and psychodynamic therapy. These different types of therapy have proven to be an effective treatment for those with depression. Also, NAMI mentioned a couple different types of antidepressant medications such as selective serotonin reuptake inhibitors (SSRIs) and serotonin and norepinephrine reuptake inhibitors (SNRIs), which are the first and second most prescribed depression medications (NAMI, 2019). In addition, the Anxiety and Depression Association of America (ADAA) commented on how the combination of medication and psychotherapy has been a great treatment for depression. They noted that combining the two has proven to treat depression more than just using one of the two by itself. The ADAA also pointed out that antidepressants do not work immediately. Instead, they can take anywhere from two to four weeks to start showing any signs that they’re working. Patients that are using medication have to be reminded of this so they do not give up on it because of a delayed effect (ADAA, 2018).
The Mayo Clinic commented on the free antidote for depression. They noted that exercise was a successful treatment for depressive symptoms and that the practice of it released feel-good endorphins along with other chemicals in the brain that enhanced one’s sense of well-being. They also pointed out that in order for exercise to be effective for treatment, the person needs to identify what they enjoy doing so they will be able to stick to it (Mayo Clinic, 2019). Ratini also commented on the release of chemicals in one’s brain due to exercise, but she pointed out that it does not have to be anything vigorous. She said to start slow with something small each day and to try and keep up with it for multiple days in a row. Some exercises she suggested included going for a short walk or run, yoga, gardening, tennis, stretching, swimming, biking, strength training, walking your dog, dancing, or any type of sporting event, such as softball or basketball. (Ratini, 2019).

**Exercise and Depression for Adolescents**

Dopp studied 18 adolescents to determine if exercise was an effective treatment in reducing depressive symptoms. He split them into two different groups, the exercise intervention (EXI) group and the treatment-as-usual (TAU) group. Participants in the EXI group were expected to exercise twice a week for 12 weeks and would fill out weekly surveys regarding activity levels, mood, and psychosocial functioning. Adolescents in the TAU group were only expected to fill out the weekly surveys with study staff. The Children’s Depression Rating Scale-Revised (CDRS-R) was used to measure depression levels before and after the 12-week period. For adolescents in the EXI condition, the average CDRS-R score went from 55 (before treatment) to 35.1 (after treatment). In the TAU group, the average score changed from 50.4 to 47.6 before and after treatment, respectively. Dopp found that when comparing participants in the EXI condition with those in the TAU condition, reductions in CDRS-R scores were
significantly greater for those in the EXI condition. Thus, he concluded that the adolescents studied, who put exercise into practice, saw reductions in their depressive symptoms (Dopp, 2018).

McMahon studied 11,110 adolescents to determine if sport participation was associated with lower depressive symptoms. Rather than an exercise intervention, McMahon decided to compare the depression levels of the least active kids (0-3 days) to the levels of the most active kids (8-14 days). She also made sure to compare boys to boys and girls to girls. To measure these levels of depression, McMahon used the Beck Depression Inventory (BDI). Results about the least active boys compared to the most active boys showed mean scores of 7.3 and 5.2, respectively. For the least active girls, the mean was 9.9, whereas for the most active girls, it was 8.5. As it can be seen, McMahon concluded that the more exercise implemented in the lives of these adolescents studied, the less depression they experienced (McMahon, et al., 2017).

Carter studied 87 adolescents aged 14-17 years who were receiving treatment for depression to determine if an exercise intervention would lower depression levels. To measure this, the Children’s Depressive Inventory (CDI-2) was used, which is a 28-item assessment of levels of depression. The exercising consisted of circuit training which was comprised of an interval pattern with eight separate exercise-stations. The stations consisted of aerobic and strengthening exercises: arm-based exercises with two medicine balls from the supine position; back and abdominal exercises from the prone and supine positions; body-weight squat exercise against the wall; stationary cycling; bouncing, dynamic/static balance exercises on a trampoline. The average score pre-intervention was 12, but this score decreased to 5 post-intervention, which was at the six-month follow-up. Thus, Carter concluded that starting adolescents on an exercise program helped to lower the depressive symptoms in the individuals studied (Carter, et al.,
Ogawa studied 983 adolescents aged 12-17 to determine if any amount of physical activity affected depression. The adolescents were split into two groups, one of which would be getting adequate physical activity (according to the amount recommended by the World Health Organization) while the other did not. He used the General Health Questionnaire-12 (GHQ-12) to evaluate depressive symptoms post physical activity. He found that the students who were not getting an adequate amount of physical activity scored an average of 3.21 on the GHQ-12, whereas the students who were getting an adequate amount had a lower mean score of 2.16. Thus, Ogawa concluded that those obtaining an adequate amount of physical activity had lower levels of depression (Ogawa, et al., 2019).

Olive studied 821 adolescents to determine if a physical education intervention would lower depressive symptoms. Depression was measured with a modified version of the Children’s Depressive Inventory (CDI), and the mean score was 25.29 before intervention. The physical education took place during a 4-year period and consisted of 50 minute sessions two times a week. After the four years, the mean depression score dropped to 23.20. Thus, Olive concluded that an input of physical education lowered depression levels in the adolescents studied (Olive, et al., 2019).

Ivanovic studied 332 high school students to determine if more exercise would result in lower depression scores. Depression was measured with the Depression, Anxiety, Stress scale (DASS-21) and exercise levels were measured with the Exercise Motivation Inventory 2 (EMI-2). Ivanovic asked the adolescents how often they participated in exercise, and they had the choice to answer with rarely/never or three or more times a week. He found that those who answered with rarely/never had a mean depression score of 4.68, but those who answered with
three or more times per week had a mean score of 3.01. Thus, he concluded that participating in more exercise showed for lower depression results in comparison with those who rarely exercised in the individuals studied (Ivanovic, 2018).

**Exercise and Depression for Middle-Aged Adults**

Morres studied 19 adult outpatients that had been diagnosed to have major depression. The purpose of this study was to determine if physical activity had any correlation to reducing these depressive symptoms. He gave all 19 outpatients triaxial accelerometer devices that they wore on their right hip for seven days in a row, excluding the hours that they were sleeping. The devices recorded light or moderate physical activity along with the amount of time they were sedentary. Depression was measured before and after the treatment with the Beck Depression Inventory-II (BDI-II). They could score anywhere from 0-63, with a higher score specifying greater levels of depression. The average score of this self-report before exercise was 17.10, but the scores changed dramatically to 2.92 after the week of exercise. Thus, Morres concluded that input of moderate physical activity resulted in lower levels of depression in the individuals studied (Morres, et al., 2019).

Minghetti studied 59 patients with Major Depressive Disorder (MDD) to determine if a sprint interval training (SIT) exercise protocol or continuous aerobic exercise training (CAT) should be incorporated in clinical care to reduce depressive symptoms. Both intervention groups performed SIT or CAT for a total of four weeks involving three sessions per week. SIT comprised 25 quick periods of 30 seconds at 80% of maximal power, whereas CAT consisted of 20 minutes of physical activity at 60% of maximal power. Depressive symptoms were measured with the Beck Depression Inventory-II (BDI-II) before and after intervention. Before intervention, Minghetti found that the average score of the BDI-II for the SIT group was 31 and
35 for the CAT group. He discovered, though, that both of these averages decreased after the four-week intervention. SIT scores decreased to a mean of 18, and CAT scores decreased to 22. Thus, Minghetti concluded that an intervention of SIT or CAT should be included to reduce symptoms of depression in the individuals studied (Minghetti, et al., 2018).

Table 1. Depressive Symptoms Pre- and Post-Intervention (Minghetti, et al., 2018)

Table 1 showed depressive variables recorded from the BDI-II comparing the SIT and CAT interventions, showing the differences in levels of depression before and after intervention (Minghetti, et al., 2018).

Singh studied 370 college students between the ages of 18-25 who consented to take part in a study to determine whether or not there was an association between depression and leisure-time physical activity. The students were asked how many hours they had spent doing leisure-time physical activity in the past week. They were split into three different groups, and the number of students that took part in >4 hours was 22 for group one, 13 students for group two, and five students for group three. The Center for Epidemiologic Studies Depression Scale for Children (CES-DC) was used to assess mental health by measuring current levels of depressive
symptoms, with 15 being suggestive of depressive symptoms. Singh found that the average score of the CES-DS was 13.6 for group one, 22.7 for group two, and 21.1 for group three. According to these results, she concluded that the lower the levels of physical activity, the higher the association with depressive symptoms in the individuals studied (Singh, et al., 2018).

McDowell studied 10,000 Irish adults to determine if meeting the guidelines for physical activity (PA) was associated with lower levels of depression. The International Physical Activity Questionnaire (IPAQ) was used to measure the amount of physical activity that was being done, and the Center for Epidemiologic Studies Depression Questionnaire (CES-D) was used to measure levels of depression. McDowell found that meeting the PA guidelines was directly correlated with 44.7% lower odds of elevated depressive symptoms. Thus, he concluded that the amount of depression was lower for individuals who meet the PA guidelines in the individuals studied (McDowell, et al., 2018).

Helgadóttir studied 310 participants between the ages of 18-67 years to determine if exercise was an effective treatment for depression. The Patient Health Questionnaire-9 (PHQ-9) was used to measure levels of depression with possible scores ranging from 0-30. A score of ten or above indicated depressive symptoms. Exercise was measured using pulse watches or self-reports for 12 weeks straight. The people who adhered to the exercise sessions averaged 22.9 workouts across the 12-week period. The people who did not adhere averaged 4.7 workouts. Due to the PHQ-9, the amount of non-adherers that had a score greater than or equal to ten was 61.9%, which is more than half of the participants. The adherers showed to have lower levels of depressive symptoms with their PHQ-9 scores being lower than ten. Thus, Helgadóttir concluded that those participating in any form of physical activity resulted in lower levels of depression in the individuals studied (Helgadóttir, et al., 2018).
Munuswamy studied 30 patients between the ages of 20-60 with depression to determine if aerobics had any effect on depression. These patients took part in 1 month of aerobic activities including cycling, gardening, swimming, jogging, walking, and dancing. Before and after this 1 month of exercising, the levels of depression of these patients were measured using the Hamilton depression rating scale (HAMD). A score ranging from 0-7 represented a normal subject, whereas a score anywhere between 8-18 meant they were diagnosed with depression. She found that the average score of the 30 patients before exercising was 12.73, but this decreased to 9.46 after the month of aerobic exercising. Thus, Munuswamy concluded that the practice of aerobic exercise produced a significant decrease in depressive symptoms in the individuals studied (Munuswamy, et al., 2018).

Table 2. Mean Values of Depression Score Before and After Aerobic Exercise
(Munuswamy, et al., 2018)

<table>
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<th>Depression</th>
<th>Before</th>
<th>After</th>
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<td>Mean value</td>
<td>12.73</td>
<td>9.46</td>
<td>Decreases</td>
</tr>
</tbody>
</table>

Table 2 showed depressive variables recorded from the HAMD before and after the input of aerobic exercise (Munuswamy, et al., 2018).

Meyer studied 24 women diagnosed with major depressive disorder (MDD) over a course of eight weeks to determine if there was any correlation with exercise lowering depressive symptoms. Once weekly, these women would undergo a 30-minute workout session at the intensity of either light, moderate, or hard. The workout consisted of sitting on an electronically braked cycle ergometer while measurements of ventilation, oxygen consumption, carbon dioxide production, and work rate were obtained and analyzed. To evaluate depressive symptoms, Meyer used the Beck Depressive Inventory-II (BDI), which had a score range from 0-63 with 14-19
representing mild depression, 20-28 representing moderate depression, and anything above 29 indicating severe depression. He had these women complete the BDI before and after the eight weeks, with the average score being 21 beforehand. After the exercise intervention, the average score decreased to 17. Thus, Meyer concluded that even relatively mild physical activity had useful therapeutic effects in lowering levels of depression in the individuals studied (Meyer, et al., 2016).

Rezaei studied 51 hemodialysis patients to determine if the input of a regular exercise program could decrease the amount of depressive symptoms they had. The Beck Depression Inventory (BDI) scale was used to measure these symptoms before and after the program, and the scores ranged from 0-63, with a higher score indicating more depression. Exercising took place three times a week for ten weeks at home, and each session would last about 35 minutes. The types of exercise in this program included stretching, deep breathing, joint warming actions, and motions with lower back muscles and abdomen. Rezaei found that the mean of depression for these patients was 23.8 before exercising, but this reduced to 11.07 after exercising. Thus, she concluded that exercise helped in reducing depression for the hemodialysis patients in this study (Rezaei, et al., 2015).

Hallgren studied 945 adults, ages 18-71, to determine if exercise should be considered treatment for those with mild to moderate depression. They participated in a 12-week exercise program, and the Montgomery–Åsberg Depression Rating Scale (MADRS) was used to measure depression levels after the intervention. This is a 67-item scale, and the mean score of the adults post-intervention was 11.4, indicating low levels of depression. Thus, Hallgren concluded that exercise should in fact be considered treatment for mild to moderate depression in the individuals studied (Hallgren, et al., 2016).
Battaglia studied 64 imprisoned men to determine if physical exercise was effective in reducing depression. She had them split into two exercise groups, where they performed cardiovascular plus resistance training (CRT) and high-intensity strength training (HIST), and a control group that didn’t take part in exercise. Before and after the 9-month experimental period, all participants completed a checklist that measured levels of depression called the Symptom Checklist 90-Revised (SCL-90-Revised). Battaglia found that the average score of the exercise groups changed from .48 to .25 before and after exercise, respectively, showing a decrease in depressive symptoms. The average score of the control group without exercise actually increased throughout the 9-month period from .34 to .77. Thus, Battaglia concluded that the implementation of exercise across a period of time showed a decrease in levels of depression in the individuals studied (Battaglia, et al., 2015).

Cofre-Lizama studied 16 adults to determine if a comprehensive treatment program had any effect on depression levels of severe and morbid obese patients. The treatment intervention lasted a total of eight months and depression levels were measured with the Beck Depression Inventory-II (BDI-II) before and after to see if there was a correlation between the two. Exercise consisted of running and overloading large muscle groups, such as the trunk flexors, knee extensors and plantiflexors, forearm flexors and extenders, pectorals, and shoulder lifts. The mean score for depression pre-intervention was 32.81, but this number decreased dramatically to 6 post-intervention. Thus, Cofre-Lizama concluded that exercise was a great treatment for lowering depression levels in the individuals studied (Cofre-Lizama, et al., 2017).

Loprinzi studied 192 college students to determine if there was a correlation between habitual engagement in exercise and depression symptomology. He had them complete a survey about their current exercise called the Physical Activity Vital Signs Questionnaire (PAVS),
which evaluated the days per week and minutes per day of physical activity they did. To meet the Moderate to Vigorous Physical Activity (MVPA) guidelines, they had to engage in at least 150 minutes per week of physical exercise. They also completed the Patient Health Questionnaire-9 (PHQ-9) to determine depression levels. Loprinzi found that 57.8% of these college students met the MVPA guidelines and they had an average score of 4.2 from taking the PHQ-9, which indicated no depressive symptoms. This left 42.2% college students who were not meeting the 150 minutes per week of physical exercise, and the mean score of the PHQ-9 was 9.8, which indicated depressive symptoms. Thus, Loprinzi concluded that the higher levels of depression symptomology were associated with lower levels of physical exercise, and the lower levels of depression symptomology were associated with higher levels of physical exercise in the individuals studied (Loprinzi, 2019).

Haller studied 20 patients to determine if an 8-week Web-based exercise intervention would have any effect on moderate to severe depression. They were split into two groups, one exercise group and one control group. Before and after the eight weeks, depression levels were recorded using the self-rated Quick Inventory of Depressive Symptomology (QIDS-SR), with the average score being 16 before intervention. The intervention consisted of patients in this group receiving weekly instructions of the endurance and strength training exercises they performed each week. Post-exercise, the average score decreased to 12. Thus, Haller concluded that exercise intervention had a positive effect on depression by decreasing its levels in the individuals studied (Haller, et al., 2018).

Son studied 846 hypertension patients aged 19 or older to determine if physical activity lowered depressive symptoms for those with hypertension. Depression was assessed with the Patient Health Questionnaire (PHQ-9), which was created from the criteria of the Diagnostic and
Statistical Manual of Mental Disorders IV (DSM-IV). Physical activity was recorded using the Global Physical Activity Questionnaire (GPAQ), which was created by the World Health Organization (WHO). The GPAQ assesses: (1) transport physical activity, (2) work physical activity, and (3) leisure-time physical activity. After filling out the GPAQ, the group of patients that had their physical activity adjusted had a lower average depression score (according to the PHQ-9) than the group that had no physical activity intervention. These averages were 4.42 and 5.93, respectively. Thus, Son concluded that physical activity should be a lifestyle modification for the hypertensive patients dealing with depression (Son, et al., 2018).

Werneck studied 59,401 Brazilian adults to determine if watching more TV was associated with less physical activity and higher depression levels. Physical activity was measured using a questionnaire, and the recommended amount was 150 minutes per week. To determine the amount of TV that was being watched, they were asked how many hours a day they spent time watching it. To measure depression, the Patient Health Questionnaire (PHQ-9) was used. Werneck found that when these adults were watching less than five hours of television per day, their depressive symptoms were at an average of 7.4, while their physical activity was at a mean of 139.3 minutes per week. For those that watched more than five hours of television each day, depression was at an average of 13.1, while physical activity was at 105.7 minutes per week. Thus, he concluded that meeting the recommended physical activity levels reduced the relation between TV-viewing and depressive symptoms (Werneck, et al., 2019).

Lambert studied 62 people with the average age being 32 to determine if a web-based physical activity intervention would reduce symptoms of depression. They were split into a control group and an intervention group, where the intervention group would partake in the web-based exercises. The depression levels were measured before and after the 8-week program with
the Patient Health Questionnaire (PHQ-8) as the measuring tool. The mean score before intervention was 14.6. The web-based program helped the participants establish daily routines and implement physical activity into their weeks. After the eight weeks, PHQ-8 scores were taken again, and the mean score of the intervention group decreased to 8.7. Thus, Lambert concluded that a web-based program was beneficial in lowering depressive symptoms in the individuals studied (Lambert, et al., 2018).

Youssef studied 40 patients with type 2 diabetes to determine if exercise would improve the depression scale results for these individuals. They were split into two exercise groups with group one participating in walking three times a week for 30 minutes at a time while group two did aerobic exercise on stationary bicycles. The hospital scale of depression was used to measure depression levels pre- and post-treatment. For groups one and two, the average scores pre-treatment were 15.6 and 17.9, respectively. After partaking in physical activity, it could be seen that there were other benefits from exercise (as is seen in tables 1 & 2) along with a decrease in depression levels. Scores for groups one and two dropped to mean scores of 8.3 and 8.95, respectively, thus showing a 46.70% improvement for group one and a 50% improvement for group two. Thus, Youssef concluded that both types of exercise resulted in lower depression levels in the individuals studied (Youssef, 2019).

Table 3. Group 1 (Walking Group) Pre-Treatment and Post-Treatment (Youssef, 2019)

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre</th>
<th>Post</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>34.5±2.328</td>
<td>33.050±1.932</td>
<td>2.02</td>
<td>0.057</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>142.95±8.36</td>
<td>141.20±6.67</td>
<td>0.68</td>
<td>0.508</td>
</tr>
<tr>
<td>Fasting glucose (mg/dl)</td>
<td>170.65±20.24</td>
<td>159.00±19.57</td>
<td>2.58</td>
<td>0.018*</td>
</tr>
<tr>
<td>Time up and go (s)</td>
<td>58.95±3.83</td>
<td>44.60±6.14</td>
<td>8.86</td>
<td>0.000**</td>
</tr>
<tr>
<td>Static balance (s)</td>
<td>6.900±1.518</td>
<td>12.050±1.605</td>
<td>−10.32</td>
<td>0.000**</td>
</tr>
<tr>
<td>Six minutes’ walk (m/6 min)</td>
<td>208.5±14.22</td>
<td>239.65±11.52</td>
<td>−6.56</td>
<td>0.000**</td>
</tr>
<tr>
<td>Measure of muscle power (s)</td>
<td>32.55±9.70</td>
<td>27.35±1.69</td>
<td>2.36</td>
<td>0.029*</td>
</tr>
<tr>
<td>Measure of endurance (no/min)</td>
<td>7.350±0.988</td>
<td>12.600±1.818</td>
<td>−11.92</td>
<td>0.000**</td>
</tr>
<tr>
<td>2 min stair climbing (no/2 min)</td>
<td>6.200±1.322</td>
<td>9.250±0.716</td>
<td>−10.36</td>
<td>0.000**</td>
</tr>
<tr>
<td>Squat test (no/min)</td>
<td>5.500±1.235</td>
<td>9.550±1.468</td>
<td>−9.00</td>
<td>0.000**</td>
</tr>
<tr>
<td>Hospital scale of depression</td>
<td>15.600±2.088</td>
<td>8.300±1.218</td>
<td>16.75</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

'Significant difference at P value less than 0.05. **Highly significant difference at P value less than 0.001.'
Table 3 showed depressive variables recorded from the hospital scale of depression comparing
the pre-treatment versus post-treatment for the walking group (Youssef, 2019).

Table 4. Group 2 (Aerobic Exercise Group) Pre-Treatment and Post-Treatment (Youssef, 2019)

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre</th>
<th>Post</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>34.8±1.963</td>
<td>32.8±1.196</td>
<td>4.02</td>
<td>0.001**</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>146.75±7.63</td>
<td>140.95±3.69</td>
<td>3.16</td>
<td>0.005*</td>
</tr>
<tr>
<td>Fasting glucose (mg/dl)</td>
<td>166.70±19.41</td>
<td>138.00±10.86</td>
<td>4.96</td>
<td>0.000**</td>
</tr>
<tr>
<td>Time up and go (s)</td>
<td>58.90±5.69</td>
<td>41.70±4.39</td>
<td>16.57</td>
<td>0.000**</td>
</tr>
<tr>
<td>Static balance (s)</td>
<td>7.800±0.768</td>
<td>17.050±2.212</td>
<td>−17.06</td>
<td>0.000**</td>
</tr>
<tr>
<td>Six minutes’ walk (m/6 min)</td>
<td>224.50±3.07</td>
<td>243.75±8.98</td>
<td>−9.69</td>
<td>0.000**</td>
</tr>
<tr>
<td>Measure of muscle power (s)</td>
<td>36.950±1.731</td>
<td>25.150±1.137</td>
<td>26.53</td>
<td>0.000**</td>
</tr>
<tr>
<td>Measure of endurance (no/min)</td>
<td>7.350±1.348</td>
<td>13.350±1.040</td>
<td>−15.92</td>
<td>0.000**</td>
</tr>
<tr>
<td>2 min stair climbing (no/2 min)</td>
<td>6.650±1.089</td>
<td>10.150±1.137</td>
<td>−10.66</td>
<td>0.000**</td>
</tr>
<tr>
<td>Squat test (no/min)</td>
<td>5.350±1.089</td>
<td>9.700±0.733</td>
<td>−14.43</td>
<td>0.000**</td>
</tr>
<tr>
<td>Hospital scale of depression</td>
<td>17.900±1.553</td>
<td>8.950±1.432</td>
<td>15.61</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

*Significant difference at P value less than 0.05. **Highly significant difference at P value less than 0.001.

Table 4 showed depressive variables recorded from the hospital scale of depression comparing
the pre-treatment versus post-treatment for the aerobic exercise group (Youssef, 2019).

Yoshikawa studied 715 Japanese employees to determine if physical exercise had an
effect on depressive symptoms. He had their depressive levels measured with the Center for
Epidemiologic Studies Depression (CES-D) scale and physical exercise recorded with a self-
report questionnaire. He also measured social support with the Social Support Questionnaire
(SSQ) to see if that had an effect on depression. The employees were asked to fill out the self-
report, and this determined if they were involved in regular physical exercise or not. Those that
did regular exercising had a lower average depression score of 9.2 compared to the group that
did not exercise regularly with an average of 10.4. Yoshikawa also found that the people with
lower depression scores also had a higher social support system. Thus, he concluded that
physical exercise had a positive effect on the depressive levels in the individuals studied
(Yoshikawa, et al., 2016).
Danielsson studied 13 people diagnosed with Major Depressive Disorder (MDD) to determine if physical exercise would serve as treatment for depression. He used the Montgomery-Asberg Depression Rating Scale (MADRS) to record depression before and after intervention. Intervention consisted of a 10-week exercise program where they performed aerobic exercises twice weekly for 45-60 minutes at a time. Aerobic exercises included a warm-up, stationary bikes, treadmills, rowing machines, Pilates, weights, jump ropes, and a cool-down that involved low-intensity movements and stretching. Before this aerobic intervention, Danielsson found that the average depression score measured from the MADRS for these 13 people was 23. After the ten weeks, the average score decreased dramatically to 12. Thus, Danielsson concluded that the input of physical exercise showed a major improvement in depression scores in the individuals studied (Danielsson, et al., 2016).
Exercise and Depression for Older Adults

Jin studied 30 older Korean women to determine the effect of a long-term exercise intervention on depressive symptoms. The women were administered a 15-item self-report GDS-K with scores ranging from 0-15, where the score of an eight or above indicated the presence of depression. They were split into an exercise group or a control group, where the exercise group engaged in resistance exercise along with walking two times per week on nonconsecutive days for six months. Repeated measurements of percent body fat, lean body mass, handgrip strength, 6-min walking, 2.44-m Up and Go, and waist circumference were taken as well. Jones found that after six months of treatment, the 15 women that were a part of the exercise group had a significant decrease in GDS-K scores from 8.7 to 6.5, while the participants in the control group did not. Also, the participants in the exercise group had significant decreases in percent body fat from 41.1% to 39.5% and waist circumference from 94.7 to 91.7 cm. This was in conjunction with a significant increase in lean body mass from 17.9 to 18.3 kg after the exercise intervention, while the participants in the control group did not. Thus, he concluded that long-term exercise resulted in reduced symptoms of depression in the individuals studied (Jin, et al., 2019).

Table 6. Depressive Symptoms and Body Composition Parameters of Pre- and Post-Intervention (Jin, et al., 2019)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Control (n=12)</th>
<th>Exercise (n=13)</th>
<th>F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
<td>Pre-test</td>
<td>Post-test</td>
</tr>
<tr>
<td>SGDS-K (scores)</td>
<td>8.7±0.7</td>
<td>6.5±1.1</td>
<td>8.6±0.8</td>
<td>8.8±1.3</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.0±2.1</td>
<td>26.7±2.3</td>
<td>26.1±3.2</td>
<td>25.8±3.2</td>
</tr>
<tr>
<td>Body fat (%)</td>
<td>42.0±6.0</td>
<td>41.9±6.6</td>
<td>41.1±6.1</td>
<td>39.5±7.0</td>
</tr>
<tr>
<td>LBM (kg)</td>
<td>17.3±1.7</td>
<td>16.4±2.2</td>
<td>17.9±2.1</td>
<td>18.3±1.8</td>
</tr>
<tr>
<td>WC (cm)</td>
<td>95.3±5.8</td>
<td>95.0±7.1</td>
<td>94.7±8.4</td>
<td>91.7±9.3</td>
</tr>
</tbody>
</table>

Table 1. Depressive symptoms and body composition parameters of pre- and post-intervention.
Table 6 showed variables recorded in the control group and exercise group in relation to symptoms of depression (Jin, et al., 2019).

**Figure 1. Flow Chart of the Study Design (Jin, et al., 2019)**

Figure 1 showed the recruitment, baseline assessment, exercise intervention, control intervention, and post-intervention assessment of the 30 older Korean women (Jin, et al., 2019).

Langoni studied 26 older adults to determine if exercise intervention lowered depressive symptoms. He assessed their symptoms before and after the intervention of exercise with the Geriatric Depression Scale-15 (GDS-15). The results before the addition of exercise showed that 11 out of the 26 adults had depressive symptoms. The adults were then submerged in strength and aerobic exercises that consisted of walking, dumbbells, elastic bands, and ankle weights. This was done over a span of 24 weeks, and the adults would exercise twice a week for 60 minutes each workout. After the 24 weeks, the amount of people with symptoms of depression decreased to 5 out of the 26 people. Thus, Langoni concluded that with exercise intervention, the amount of depressive symptoms decreased in the individuals studied (Langoni, et al., 2018).

Ortiz studied 25 institutionalized older adults to determine if the input of an exercise program would reduce depressive symptoms. The exercise program took place over a span of 12
weeks and consisted of chair exercises of moderate intensity for five days a week for 40-50 minutes per session. Depressive symptoms were measured before and after the 12 weeks of exercise with the Yesavage Geriatric Assessment Scale. This 0-15 point scale indicated symptoms of depression with a score of five or more. The results for males before and after the program changed dramatically from a score of 8.2 to 2.9 respectively. For females, depressive symptoms also decreased with scores starting at 8.5 and changing to 1.6 post exercise. Thus, Ortiz concluded that consistent exercise reduced depressive symptoms in the individuals studied (Ortiz, et al., 2019).

**Table 7. Descriptive Statistics for Affective and Physical Variables in Older Adults from a Retirement Home (Ortiz, et al., 2019)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experimental (n = 10)</th>
<th>Control (n = 10)</th>
<th>Experimental (n = 15)</th>
<th>Control (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr.)</td>
<td>73.1 ± 6.8 -</td>
<td>75.9 ± 5.7 -</td>
<td>75.2 ± 5.8 -</td>
<td>72.7 ± 6.2 -</td>
</tr>
<tr>
<td>DS (pts.)</td>
<td>8.2 ± 6.1 2.9 ± 3.5</td>
<td>10.3 ± 5.2 10.0 ± 4.8</td>
<td>8.5 ± 2.8 1.6 ± 2.2</td>
<td>6.7 ± 4.8 10.2 ± 4.4</td>
</tr>
<tr>
<td>FC (pts.)</td>
<td>4.1 ± 2.1 5.5 ± 0.7</td>
<td>4.8 ± 1.0 3.3 ± 0.7</td>
<td>3.5 ± 1.6 5.6 ± 0.6</td>
<td>4.9 ± 1.1 3.1 ± 0.8</td>
</tr>
<tr>
<td>Gait (pts.)</td>
<td>12.5 ± 7.6 19.7 ± 8.2</td>
<td>16.8 ± 5.2 13.1 ± 5.4</td>
<td>10.4 ± 6.8 19.0 ± 6.9</td>
<td>20.7 ± 4.4 15.9 ± 4.8</td>
</tr>
</tbody>
</table>

Note: DS: Depressive state; FC: Functional capacity.

Table 7 showed variables recorded in the control and experimental groups based on gender in relation to depressive state (Ortiz, et al., 2019).

Lee studied a group of 21 elderly adults to determine if an exercise intervention would have an effect on depression rates. He had them split into an experimental group with 11 adults and a control group with the other 10. The experimental group took part in 10 sessions of aerobic exercising, including leg stretching and aerobic cycling, while the control group attended lectures on health education. The measurements of depression were taken before and after with the Geriatric Depression Scale (GDS), which contained 15 questions. Scoring a seven or above on this scale indicated depression. For the experimental group, the mean of the GDS was 5.55 pre-
exercise and decreased to 3.00 post-exercise. For the control group, the mean of the scores was 3.85 before the lectures, and this reduced to 2.7 post lecturing. Lee found that there was a larger change in mean scores with the experimental group, thus, he concluded that the exercise intervention had a greater effect on depression than the lectures did in the individuals studied (Lee, et al., 2017).

Oliveira studied 200 elderly people of both genders to determine if an intervention of exercise had an effect on their depression levels. They were split into two groups of 100, with the first group being involved in physical activity and the second group being sedentary. Oliveira used the Hospital Anxiety and Depression Scale (HADS-D) to assess depression in the elderly adults. A score of 0-8 indicated no signs of depression or mild depression, whereas a score of 9 or higher indicated severe depression. Oliveira found that the sedentary group had a range of scores from 1.65-9.97, and the active group had a range of 0-6.23. Thus, she concluded that the involvement of physical activity caused for lower levels of depression in the individuals studied (Oliveira, et al., 2019).

**Table 8. Comparison of Variables Between Sedentary and Active Elderly Living in the Community (Oliveira, et al., 2019)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sedentary</th>
<th>Active</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>72.56±5.68&lt;sup&gt;a&lt;/sup&gt;</td>
<td>69.75±4.36&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0001</td>
</tr>
<tr>
<td>Physical activity level</td>
<td>5.81±2.31&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15.81±5.48&lt;sup&gt;b&lt;/sup&gt;</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Anxiety scale (HADS-A)</td>
<td>5.23±3.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.78±3.71&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0001</td>
</tr>
<tr>
<td>Depression scale (HADS-D)</td>
<td>5.81±4.16&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.01±3.22&lt;sup&gt;b&lt;/sup&gt;</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Functional capacity</td>
<td>68.51±26.41&lt;sup&gt;a&lt;/sup&gt;</td>
<td>76.35±24.96&lt;sup&gt;b&lt;/sup&gt;</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Physical aspects</td>
<td>37.26±41.37&lt;sup&gt;a&lt;/sup&gt;</td>
<td>64.32±42.57&lt;sup&gt;b&lt;/sup&gt;</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Ache or pain</td>
<td>64.17±27.28&lt;sup&gt;a&lt;/sup&gt;</td>
<td>74.61±27.87&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0081</td>
</tr>
<tr>
<td>General state of health</td>
<td>71.62±17.99&lt;sup&gt;a&lt;/sup&gt;</td>
<td>79.22±16.54&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0022</td>
</tr>
<tr>
<td>Vitality</td>
<td>62.93±23.18&lt;sup&gt;a&lt;/sup&gt;</td>
<td>76.72±21.46&lt;sup&gt;b&lt;/sup&gt;</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Social aspects</td>
<td>72.84±31.71&lt;sup&gt;a&lt;/sup&gt;</td>
<td>89.45±19.50&lt;sup&gt;b&lt;/sup&gt;</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Emotional aspects</td>
<td>71.79±42.77&lt;sup&gt;a&lt;/sup&gt;</td>
<td>82.64±35.88&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0500</td>
</tr>
<tr>
<td>Mental health</td>
<td>69.40±24.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>78.79±20.22&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.0041</td>
</tr>
</tbody>
</table>

Table 8 showed depressive variables recorded from the HADS-D comparing the sedentary versus
active groups among the elderly community (Oliveira, et al., 2019).

Choi studied 77 older participants to determine if the implementation of a floor-seated exercise program (FSEP) would result in reduced depression levels. Choi split the people into two groups, group one being the ones to participate in the FSEP and group two being the control group. The intervention lasted 12 weeks, and group one performed FSEP four days each week with each one lasting 30-40 minutes. Depression levels before intervention were measured to be an average of 5.88 for group one and 4.57 for group two with the Geriatric Depression Scale Short Form-Korean version (GDSSF-K). Choi found that after the 12 weeks, depression levels decreased to 3.82 for the exercise group, while the score increased to 4.63 for the control group. Thus, he concluded that the FSEP program resulted in lower levels of depression in the individuals studied (Choi, 2018).

Heinzel studied 1,063 older adults to determine if exercise served as a successful intervention in lowering depression levels. For all of the adults that wanted to be a part of the intervention group study, they had to meet the exercise criteria according to the American College of Sport Medicine (ACSM). In order to figure this out, Heinzel had all those that were interested put into different conditions of intervention, and he eventually split them up into an intervention group and a control group based on meeting the ACSM criteria or not. After they were split, the intervention group took part in aerobic and resistance exercise, while the control group didn’t. To measure depression levels, he used the Geriatric Depression Scale-15 (GDS-15) (Heinzel 2015), which he then compared the intervention versus control groups’ scores. The intervention group averaged a GDS-15 score of 7.52 post-treatment, whereas the control group had a higher averaged score of 10.29. Thus, Heinzel concluded that exercise served as an accomplishment toward lowering symptoms of depression in the individuals studied (Heinzel, et
Dziubek studied 28 hemodialysis patients to determine if a 6-month exercise program would lower depression symptoms. He used the Beck Depression Inventory (BDI) to measure levels of depression before and after the six months. Beforehand, the mean level of depression recorded from the BDI was 15.5. The exercise program consisted of a warm-up, endurance training, strength training, and a cool-down for three days per week. After the six months of consistent exercising, Dziubek saw a decrease in depression levels among the hemodialysis patients. The mean score reduced to 11.6, thus he concluded that the input of a consistent exercise program showed for a decrease in the amount of depression in the hemodialysis patients studied (Dziubek, et al., 2016).

Table 9. The Level of Depression and Anxiety at the Start of Training (t1) and After 6 Months (t2) in the Study Group (n = 28) (Dziubek, et al., 2016)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (SD)</th>
<th>Median</th>
<th>Wilcoxon Test</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI</td>
<td>t1 15.5(9.3)</td>
<td>12.5</td>
<td>2.50</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td></td>
<td>t2 11.6(9.3)</td>
<td>9.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAI X1</td>
<td>t1 39.3(11.8)</td>
<td>39.0</td>
<td>0.30</td>
<td>0.761</td>
<td></td>
</tr>
<tr>
<td></td>
<td>t2 38.2(9.2)</td>
<td>39.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAI X2</td>
<td>t1 41.7(9.6)</td>
<td>40.5</td>
<td>1.66</td>
<td>0.096</td>
<td></td>
</tr>
<tr>
<td></td>
<td>t2 39.1(9.2)</td>
<td>38.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9 showed depressive variables recorded from the BDI before (t1) and after (t2) exercise intervention (Dziubek, et al., 2016).

Silva studied 504 older adults to determine if exercise was associated with lower levels of
depression. Depression was measured with a shorter version of the Geriatric Depression Scale (GDS) that was translated into Portuguese. Physical activity was evaluated with the Rapid Assessment of Physical Activity (RAPA) questionnaire, which was also in Portuguese. The RAPA was specifically made for older adults to fill out because it takes less than ten minutes to do and consists of nine items to answer about their physical activity. Based on their answers, they got put into one of five categories, the five categories being: 1) sedentary, 2) underactive, 3) regular underactive, light activities, 4) regular underactive, and 5) regular active. Silva found that those who were regularly active had lower depression levels than those who were sedentary. The results were as follows. The people with the highest depression levels were those who were in the sedentary category - there were 60 people in this category. On the other hand, the number of people who were regularly active came to a head count of eight people having depressive symptoms. Thus, Silva concluded that those participating in regular exercise were less likely to be dealing with depression in the individuals studied (Silva, et al., 2016).
Chapter 3

Introduction

The statement of the problem, summary, conclusions, and recommendations for further study are discussed in this chapter. In 2017, it was estimated that 17.3 million adults living in the United States had at least one major depressive episode, which came to be 7.1% of all adults. Depression is prevalent in adolescents, adults, and older adults and is very closely linked to other illnesses such as cancer, strokes, heart attacks, coronary artery disease, HIV, Parkinson’s disease, eating disorders, substance use, diabetes, and polycystic ovary syndrome (DBSA, 2019). In a 2019 review, causes of depression were related to personal factors, some being personality, drug or alcohol use, family history, or a serious medical illness. Personality can be a depressive trigger if it causes them to have a low self-esteem or high levels of worry (Beyond Blue, 2019). It is important to implement exercise while going through depression because the results have proven to be very beneficial. Exercise causes the body to release hormones and endorphins, which results in new connections being made and nerve cell growth. This improvement in brain function helps someone feel better. It has been seen in people with depression that the hippocampus is smaller. When new connections form due to exercise, the hippocampus actually increases in size because of the nerve cell growth, which ultimately helps in relieving depression (HHP, 2018).

Summary and Statement of the Problem

This researcher reviewed literature that pertained to the positive effects of exercise on depression in adolescents, middle-aged adults, and older adults. Thirty-four professional medical journals and eight professional websites were researched. Conclusions were drawn concerning the health and mental effects of exercise on depression in adolescents, middle-aged adults, and
older adults. The purpose of this study was to examine the effects of exercise on depression in adolescents, middle-aged adults, and older adults.

**Conclusions**

The effects of exercise on depression in adolescents were closely examined. Dopp studied 18 adolescents and found that exercise intervention helped in reducing symptoms of depression. His results showed a 19.9-point decrease in symptoms of depression for the exercise intervention group as compared to a 2.8-point decrease in the treatment-as-usual group from before and after the study, respectively (Dopp, 2018). Another study on 11,110 adolescents was done to determine if sport participation was associated with lower depressive symptoms. McMahon used the Beck Depression Inventory (BDI) to measure levels of depression and found that the more active the child was, the lower his/her depression score. Results for the least active boys compared to the most active boys showed mean scores of 7.3 and 5.2, respectively. (McMahon, et al., 2017). Carter studied 87 adolescents to determine if circuit training, which included aerobic and strengthening exercises, back and abdominal exercises, and body-weight exercises, would help in lowering depression levels. He found that the pre-intervention score of 12 decreased to a post-intervention score of 5 (Carter, et al., 2015). Another study involved Ogawa splitting adolescents into two groups to see if depression decreased with physical activity. He found that those getting adequate exercise had lower depression levels (2.16) than those that were not getting adequate amounts of exercise (3.21) (Ogawa, et al., 2019). In two similar studies, Olive and Ivanovic studied adolescents to determine if any amount of physical activity effected depression. Olive’s studies took place across four years with measured scores of depression before (25.29) and after (23.20), while Ivanovic’s studies consisted of asking the adolescents how often they participated in exercise with results being 3.01 for those who
exercised and 4.68 for those who rarely did. Both researchers arrived at the conclusion that participation in exercise resulted in lower depression levels (Olive, et al., 2019) (Ivanovic, 2018).

The effects of exercise on depression in middle-aged adults were closely examined. Morres studied 19 adult outpatients that had major depression to determine if there was any correlation between physical activity and depression. He put them through a week of training with accelerometer devices on their hips and concluded that exercise resulted in lower levels of depression, with a change from 17.10 to 2.92 pre- and post-intervention (Morres, et al., 2019). In another study, Minghetti studied 59 patients to determine if sprint interval training (SIT) and continuous aerobic exercise training (CAT) would affect depression. Across the span of four weeks of SIT and CAT, he found that average scores of depression levels decreased from 31 to 18 after exercise (Minghetti, et al., 2018). A group of college students was studied by Singh to see if there was an association between leisure-time physical activity and depression. After putting these 370 students through a depression scale assessment, Singh found that the average score was 13.6 for group one, 22.7 for group two, and 21.1 for group three, which showed lower scores for the more active students. Thus, he concluded that with the lower levels of physical activity, there would be a higher association of depressive symptoms (Singh, et al., 2018). In a similar study, McDowell measured depression levels in 10,000 adults using the International Physical Activity Questionnaire (IPAQ) to determine if meeting physical activity guidelines was associated with lower levels of depression. He found that meeting the PA guidelines was directly correlated with 44.7% lower odds of elevated depressive symptoms (McDowell, et al., 2018). In Helgadóttir’s study, he measured exercise with pulse watches and self-reports for 12 weeks straight to see if exercise was an effective treatment for depression. He found that those who did not adhere to the exercise sessions averaged 4.7 workouts with higher depressive levels than
those who did adhere, averaging 22.9 workouts with lower depressive levels (Helgadóttir, et al., 2018). In another study, 30 patients were studied by Munuswamy to determine if cycling, gardening, swimming, jogging, walking, and dancing had any effect on depression. The subjects participated in one month of these aerobic activities, and the researchers found a significant decrease in depressive symptoms from 12.73 to 9.46, as measured by the Hamilton depression rating scale (Munuswamy, et al., 2018). Meyer studied 24 women diagnosed with major depressive disorder over the course of eight weeks to determine if there was any correlation between exercise and lower depressive symptoms. After these eight weeks of workout sessions, depression levels decreased from scores of 21 to 17 according to the Beck Depressive Inventory-II (BDI-II). Meyer concluded that physical activity was therapeutic in lowering the levels of depression for the sample studied (Meyer, et al., 2016). Rezaei studied 51 hemodialysis patients using different types of exercise across a span of ten weeks to evaluate if depression would be reduced. Depression scores decreased by 12.73 points on the Beck Depression Inventory scale, so Rezaei concluded that an exercise intervention was effective in reducing depression (Rezaei, et al., 2015). In a similar study, Hallgren studied 945 adults aged 18-71. He found that the average score from the Montgomery–Åsberg Depression Rating Scale (MADRS) was 11.4, which indicated low levels of depression (Hallgren, et al., 2016). In a study with 64 imprisoned men, Battaglia had three separate groups that performed either cardiovascular plus resistance training (CRT), high-intensity strength training (HIST), or no training to determine if depression levels could be lowered. She found that the average depression score for the exercise group decreased from .48 to .25 before and after intervention, whereas the score increased for the control group from .34 to .77 (Battaglia, et al., 2015). Next, Cofre-Lizama studied 16 adults to determine if depression levels for morbid obese patients would decrease with exercise. It lasted
eight months, and it was seen that depressive levels decreased from 32.81 to 6 pre- and post-intervention, respectively (Cofre-Lizama, et al., 2017). In two studies done by Loprinzi and Son, they both measured levels of depression for people who met adequate physical activity guidelines and for those who did not, and they compared these scores. In both studies, people who met the guidelines had lower depression scores of 4.2 and 4.42 compared to those who did not meet the guidelines with scores of 9.8 and 5.93, respectively. It can be seen that depression levels were lower for those who met adequate physical activity guidelines (Loprinzi, 2019) (Son, et al., 2018). In another study, Haller studied 20 patients to see if an 8-week Web-based exercise intervention would have any effect on moderate to severe depression. With weekly instructions of endurance and strength training exercises, Haller found that the average scores of depression decreased from pre-intervention to post-intervention with scores of 16 to 12, respectively (Haller, et al., 2018). In a similar web-based study, Lambert studied 62 people who went through an exercise intervention to see if depressive levels would reduce. After eight weeks of implemented physical activity, recorded depression went from 14.6 to 8.7 pre- and post-intervention, respectively (Lambert, et al., 2018). In Werneck’s study, 59,401 Brazilian adults were studied to determine if meeting the recommended physical activity levels would reduce depressive symptoms. He found that when recommendations were not met, depression scores were at an average of 13.1, whereas when recommendations were met, the average score was 7.4. Thus, Werneck concluded that meeting the recommended physical activity levels reduced depression scores (Werneck, et al., 2019). In another study, Youssef studied 40 patients with type 2 diabetes to determine if exercise would improve the depression scale results for these individuals. The first exercise group had a decrease in their scores from 15.6 to 8.3, while the second exercise group also found a decrease in the average score from 17.9 to 8.95. This showed a 46.70%
improve for the first group and a 50% improvement for the second group, as concluded by Youssef (Youssef, 2019). In Yoshikawa’s study of 715 Japanese employees, he measured depressive levels to see if regular exercise would help lower the average depression score. Those that did regular exercising had a lower average score of 9.2 compared to the group that did not exercise regularly with an average score of 10.4. Thus, Yoshikawa concluded that physical exercise has a positive effect on depressive levels (Yoshikawa, et al., 2016). In a similar study, Danielsson studied 13 people diagnosed with Major Depressive Disorder (MDD). Using aerobic exercise as an intervention, he found that depression scores decreased from before to after the intervention with average scores of 23 to 12, respectively (Danielsson, et al., 2016).

The effects of exercise for depression on older adults were closely examined. Jin looked at the effects of a long-term exercise intervention on depressive symptoms in 30 older Korean women. By measuring levels of depression before and after these six months of exercise, Jin found that the average score decreased from 8.7 to 6.5. It could be seen that body fat and waist circumference also decreased with the input of exercise (Jin, et al., 2019). In a similar study, 26 older adults were evaluated by Langoni during strength and aerobic exercises to see if their depression levels would decrease. The number of people that had depressive symptoms pre-intervention was 11 out of 26. After the span of 24 weeks of exercise, the number of people that were showing signs of depression reduced to 5 out of the 26 people, so the input of exercise was useful in lowering depression (Langoni, et al., 2018). An incredible study was done by Ortiz to determine if the input of chair exercises for institutionalized older adults would help in lowering depressive symptoms. Before exercise, the average score was 8.2 for males and 8.5 for females. After a span of 12 weeks of these chair exercises, the average score dramatically decreased to 2.9 for males and 1.6 for females post exercise, therefore he concluded that consistent exercise
reduced depressive symptoms in those individuals (Ortiz, et al., 2019). In another study, Lee studied a group of 21 elderly adults to determine if an exercise intervention would have an effect on depression rates. The experimental group took part in 10 sessions of aerobic exercising, and their average mean depression score decreased from pre- to post-intervention. The score went from 5.55 to 3.00, so Lee concluded that exercise had a positive effect on depression (Lee, et al., 2017). In the next study, Oliveira studied 200 elderly people to determine if an exercise intervention had an effect on their depression levels by assessing a group that participated in physical activity and a sedentary group. Oliveira found that the sedentary group had a range of scores from 1.65-9.97, and the active group had a range of 0-6.2, thus concluding that involvement in physical activity caused for lower levels of depression (Oliveira, et., al 2019). In a study done by Choi, 77 older adults participated in a floor-seated exercise program (FSEP) to determine if it would result in reduced depression levels. Before intervention, depression levels were measured to be an average of 5.88 for the exercise group and 4.57 for the control group. Choi found that after the 12 weeks, depression levels decreased to 3.82 for the exercise group, while the score increased to 4.63 for the control group, thus concluding that FSEP resulted in lower levels of depression (Choi, 2018). In another study, Heinzel studied 1,063 older adults to determine if exercise served as a successful intervention in lowering depression levels. There was an intervention group and a control group, and Heinzel had their depressive symptoms measured and compared by using the Geriatric Depression Scale-15 (GDS-15). He found that the intervention group averaged a score of 7.52 post-treatment, whereas the control group had a higher averaged score of 10.29. Thus, he concluded that exercise served as an effective treatment in lowering depressive symptoms (Heinzel, et al., 2015). In a study done by Dziubek, 28 hemodialysis patients had their depressive levels measured before and after an exercise
intervention. This was to determine if depressive symptoms decreased with the intervention. The average score was 15.5 pre-exercise, and this decreased to 11.6 post-exercise, allowing Dziubek to conclude that the input of a consistent exercise program showed for a decrease in the amount of depression in the hemodialysis patients studied (Dziubek, et al., 2016). Lastly, Silva studied 504 older adults to determine if exercise was associated with lower levels of depression. Depression and physical activity were evaluated, and that would assess whether they were more sedentary or regularly active. Silva found that the people with the highest depression levels were those who were in the sedentary category (60 people in this category), whereas the number of people who were regularly active came to a head count of eight people having depressive symptoms (Silva, et al., 2016).

**Recommendations for Further Study**

There are several recommendations for further research in regard to the topic of exercise on depression and the benefits in adolescents, middle-aged adults, and older adults. There needs to be more research on the combination of anti-depressant medication and exercise in viewing the effects on depression. There was more research about the effects of anti-depressant medication and exercise and how they separately affected depression but not enough on the combination of the two. Also, this researcher thinks there should also be a combined study of diet and exercise and how these two things effected depression as well.

When looking at the different age groups, there should be more separation between studies to see how each of the ages are effected by different types of exercise. Adolescents and older adults may not have the same results when it comes to lowering depressive symptoms with aerobic exercise. There also needs to be more research on which types of exercise benefit the depressed patient more: aerobic, anaerobic, or strength training.
Lastly, research on people with depression needs to be carried out for longer periods of time. Many articles this researcher came across dealt with studies lasting a few weeks or months, whereas there would be more accuracy with longer studies. Following adolescents, middle-aged adults, or older adults for a couple year span of time would be beneficial in seeing what benefits occur long-term in relation to depressive symptoms.
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