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EXERCISE AND DEPRESSION: A Critical Review

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Abstract

Depression is not restricted to individuals with psychiatric illness. Generalized, non-clinical depression is experienced by almost everyone at some point in life. Traditional treatments for clinical depression have been primarily psychotherapy and pharmacological interventions Unfortunately, these therapies have not always been effective and in some cases, they have side effects Practitioners and researchers have therefore started to examine possible alternatives in the treatment of clinical depression. The preponderance of available research evidence suggests that exercise has the potential to play this role. This paper examines the potential of different exercise types to decrease depression, the relationship between length of exercise programme and its effects on depression , and the effect of intensity of exercise on depression. Several hypotheses have been advanced to explain the relationship between exercise and depression, however the mechanisms by which exercise exerts its effects have not been extensively investigated nor well understood. It is therefore suggested that more studies should be conducted with strict controls on (he different modes of exercise and the severity and duration of depression.

Introduction

Depression affects more than 10% of the population in Nigeria. Most of us experience it sometime in our lives as we deal with different frustrating situations, because it is basically an emotional state (Shepel, 1984). It is characterized by a variety of symptoms, such as feelings of sadness, disturbances in sleep patterns, irritability, inability to enjoy, loss of appetite, feelings of worthlessness (National Institute of Mental Health (NIMH), 2001; American Psychiatric association (APA, 1994). It is twice as prevalent in females than in males and the risk of recurrence

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can be as high as 50%-90%. This chronic illness is extremely expensive for a nation to bear.

The classification of depression has changed over the years as a reaction to changes in the theoretical bases of depression (APA, 1994). For example, it was once considered a neurotic reaction by Freudian theory, but later came to be regarded as a biochemical reaction. This change in viewpoint paralleled advances in neurophysiologic research. Recently, with the resurgence of the popularity of psychological theories of depression, an excellent review of the different theories of depression was provided by Akiskal and McKinney (1975). They categorized 10 specific models of depression into the following psychological schools of thought:

a. Psychoanalytical
b. Behavioural
c. Sociological
d. Existential
e. Biological

In spite of the diverse viewpoints of these schools of thoughts, the American Psychiatric Association lays emphasis on symptoms and the severity of depression, ie, mild, moderate or severe.

Identifying Clinical and Non Clinical Depression

According to the Diagnostic and Statistical Manual of Mental Disorders (APA, 1987), a major depressive episode is characterized by either a depressed mood or a loss of interest or pleasure in all or most activities, together with other associated symptoms which has lasted for at least two weeks. It must be persistent and represent a significant change from previous functioning. In addition, at least five of the following associated features must also be present:

a. Loss of appetite
b. Weight loss or gain
c. Disturbed sleep
d. Psychomotor agitation or retardation
e. Decrease in energy
f. Feeling of worthlessness
g. Guilt

h. Difficulty in concentration

I. Thoughts of suicide

Depression may be a reactive, a reaction to life events, or endogenous, ie, caused by internal events. In either case, treatment is usually prescribed.

Depression is not restricted to individuals with psychiatric illness. Generalized, non-clinical depression is experienced by almost everyone at some point in life. Normal depression is usually related to some type of environmental stressor. Grief or loss is the most common cause of non-clinical depression. The loss may be related to a job or marriage. People also experience depression when they complete an important project. These periods of depression are normal and are therefore called non-clinical depression (Johnson and Miller, 1994). It is only when the depressive episodes go beyond a normal boundary in terms of frequency, intensity and duration that it becomes a mood disorder called clinical depression.

Traditional Treatments for Depression

Non-clinical depression usually subsides within a short period of time without intervention. Similarly, some instances of mild to moderate clinical depression go into spontaneous remission within six months of onset. However, many people seek professional help to deal with symptoms of depression.

Traditional treatments for clinical depression have been primarily psychotherapy and pharmacological interventions (Johnson and Miller, 1994). Unfortunately, these therapies have not always been effective and in some cases, they have side effects (Leith, 1994). Moreover, changes in health care delivery in some countries have led to time constraints for therapy and limits in payments for mental health services (Johnson and Miller, 1994). Practitioners and researchers have therefore started to examine possible alternatives in the treatment of clinical depression.

Although anti-depressant medications are known to be effective within about three weeks, they are not without side effects. The typical side effects are blurred vision, dry mouth and orthostatic hypotension (Long, 1991; Stern, Simon and Silverman, 1990). If patients fail to respond to the tricycle ATDS they are usually prescribed monoamine exidise inhibitors (MAOIs). Some of the most common MAOIs include Nardil, Parnate, and Marplan. Although these relieve depression, they are sometimes accompanied by dangerous side effects. The more critical side effects are dangerous interactions with many foods and drugs, tendency to experience hypertensive crisis, and disordered heart rate and rhythm (Long, 1991).

Because of these dangerous side effects, the MAOIs are prescribed only if the TADs do not work.

All these treatments focused on unipolar depression (mood downswing only). Another illness, called bipolar affective disorder (previously called manic depression) exhibits symptoms of mood downswing (depression) and/or mood upswing (mania). Treatment for bipolar affective disorder involves lithium medication (Fieve, 1989), which has some side effects. It can affect muscular coordination and cause fine hand trauma and lethargy. Long-term use of these drugs has been associated with kidney malfunction (Long, 1991; Stern, Simon and Silverman, 1990). The limited efficacy of the psychotherapies and the negative side effects caused by chemotherapies underscore the need for a more positive alternate treatment. The preponderance of available research evidence suggests that exercise has the potential to play this role.

Exercise And Depression

Exercise has been proposed as one of the plausible adjunct or alternative treatments to the traditional ones for depression. The first studies on exercise and depression were cross sectional; the physical activity and physical capacity levels of depressed and non-depressed individuals were compared (Martinsen, Hoffart and Solberg, 1989; Morgan, 1969). The early reviews of literature on exercise and mental health (Layman, 1960; Cureton, 1963; Morgan, 1969; Layman, 1972) focused primarily on general mental and emotional health rather than on specific psychological construct. There, however, appears to be a significant departure from this trend within the last three decades. Much of the reported research evidence suggests that exercise is associated with a significant decrease in psychometrically assessed symptoms of depression. The psychometric instruments used in such studies include the Beck Depression Inventory (Beck, Ward, Mendelson, Mock and Erbaugh, 1961), the Zunj Self Rating Depression Scale, the profile of mood state (McNair, Lorr and Droppleman, 1971), the Minnesota Multipurpose Inventory (MMPI) Depression Scale (Hathaway and McKinley, 1943), which is considered as the best discriminator between fit and unfit individuals (Lobstein, Mosbacher and Ismail 1983). Most of the exercise intervention studies examined the efficacy of exercise in alleviating depression (Brown, Welsh, Labbe, Vitulli, and Kulkami, 1992; Demeo, Baurer, Varahram, Proes and Halter, 2001; Doyne, Chambless and Beutler, 1983; Layman, 1972).

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Types of Exercise Associated With Decreased Depression

Researchers have investigated whether certain modes of exercise training are more effective in alleviating depression than others (Doyne Ossip-Klien and Bowman, 1987; Martinsen, Hoffart and Solberg, 1989). For example, significant reductions in depression have been reported after a period of training in such activities as running (Bosscher, 1993; Roth and Holmes, 1987), walking (Doyne, Ossip-Klien and Bowman 1987; Emery and Gatz, 1990; Pappas, Golin and Meyer, 1990), cycling (Doyne, Ossip-Klien and Bowman, 1989; Pelham and Campagna, 1991), weight training (Doyne, Ossip-Klien and Bowman 1987); karate (Maddi, 1984), racket ball (Pappas, Golin and Meyer, 1990), and several unspecified aerobic activities (Martinsen and Medhus, 1989; Steege and Blumenthal, 1993). However other researchers reported no change in depression following participation in running (De Geus, Lorenz, Vandoornen and Olebeke, 1993; Eby, 1985; King, Barr Taylor, Haskell and DeBusk, 1989), walking (Pierce, Madden, Siegel and Blumenthal, 1993); Sexton, Maere and Dahl, 1989), and unspecified aerobic programmes (Frederick and Ryan, 1993; Martinsen and Medhus, 1989). It should be noted here, however, that running and walking are the two types of physical activity most frequently associated with significant decrease in the depression of participants. Most studies that used these modes of exercise reported beneficial effects regarding depression.

Exercise Types and Depression

Very few studies have attempted to compare the potential of different exercise types to decrease depression. Eby (1985), for example, using male and female college students, compared the effects of running, weight lifting and running plus weight lifting on depression. The results showed that the different types of exercise had insignificant effect on depression and also that the differences in the effects between the types of exercise were insignificant. In a similar study, Doyne, Ossip-Klien and Bowman (1987), using 40 adult female, compared the effects of running (aerobics), weight lifting and no exercise on depression. The study showed significant decrease in depression due to both types of exercise without significant differences between their effects. These findings were further supported by those of Martinsen, Hoffart and Solberg (1989), and Pappas, Golin and Meyer (1990). Thus, no research evidence has yet been reported to show that one particular type of exercise is superior to another in reducing depression. Both aerobic and anaerobic exercise appear to be equally effective. 198

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Length of Exercise Programme

The relationship between length of exercise programme and its effects on depression has rarely been investigated. Simons, Epstein, McGowan, Kupfer, and Robertson, (1985) discussed the length of exercise programme required for a change in cardiovascular conditioning but not depression. Most studies on exercise and depression ranged in length from 3 weeks (Taxe, 1985) to 4 years (Kavanagh, Shephard, Tuck and Qureshi, 1977) while most training experiments lasted 10 weeks or longer. There are also studies that showed significant reduction in depression following exercise programmes of 9 weeks (Martinsen, Medhus and Sandvik, 1985), 8 weeks (Bosscher, 1993; Doyne, Ossip-Klien, and Bowman, 1987), 6 weeks (Brown, 1984; Labbe, Welsh and Delaney, 1988), 4 weeks (Federici, 1986) and 3 weeks (Taxe, 1985).

Exercise Frequency and Depression

Some studies required exercise to be performed 3 times per week (Bosscher, 1993; and King, Barr Taylor, Haskell and DeBusk, 1989), others 4 times per week (Doyne, Ossip-Klien, and Bowman, 1987; Pelham and Campagna, 1991) and yet others 2 times per week (Jewell, 1987; Maddi, 1984; Pappas, Golin and Meyer, 1990). It appears that exercise performed 3 times per week is adequate to significantly reduce depression. It also appears that a frequency greater than 4 times a week will not have any added advantage. By using these recommended range of exercise frequency, the risk of overuse injury will be minimized and the desire to continue to exercise will be maintained.

Exercise Intensity and Depression

Exercise intensity has not been consistently documented in research on the effects of exercise on depression. The few studies that reported this important variable however showed significant improvements in depression following exercise intensities of 80% VO_2 max (Doyne, Ossip-Klien and Bowman, 1989), 75% maximum heart rate (Roth and Holmes, 1987), about 60% maximum heart rate (Brown, 1984; Doyne, Ossip-Klien and Bowman, 1987; Emery and Gatz, 1990; Pelham and Campagna, 1991), about 60% VO_2 max (Bosscher, 1993; Labbe, Welsh and Delaney, 1988; Steege and Blumenthal, 1993), 50% to 70% maximum heart rate (Doyne, Ossip-Klien and Bowman, 1987; Taxe, 1985) and 50% to 70% $V0_2$ max (Doyne, Ossip-Klien and Bowman, 1989). Thus, both high and moderate intensity exercise programmes can significantly reduce depression. It is, however, advisable to use moderate intensity exercise, since it is equally effective and possesses little risk of injury and discomfort.

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Duration of Exercise and Depression

The American College of Sports Medicine (1991) recommends that exercise must be performed for 15-30 minutes to improve cardiorespiratory functioning and body composition. It further recommended that the same time frame is sufficient to promote positive mental health (Brown, 1990; Dishman, 1986; Morgan, 1988). In other studies, different durations, raging from 15 minutes to 2 hours were used. It appears that exercise duration of 15-30 minutes is sufficient to produce both physiological improvements and decreased depression.

Possible Explanation for the Association between Exercise and Decreased Depression

The consistent research evidence about the benefits of exercise to patients with depression has led many researchers to speculate about the causal mechanisms of this relationship. There has been a digression from the traditional research hypothesis development to explain these mechanisms. In traditional experimental designs, hypotheses are developed before experiments are conducted. However, in this case, hypotheses have been developed on the basis of experimental results that have been reported. Several such hypotheses have been advanced to explain the relationship between exercise and depression. It should be pointed out here that the mechanisms by which exercise exerts its effects have not been extensively investigated nor well understood. Although there are researchers who contend that exercise causes a reduction in depression, there are others who strongly feel that more research evidence is required before a causal connection can be established (Landers and Arent, 2001). Research reported so far has not extensively examined the plausible mechanisms suggested in the literature. A better understanding of the mechanisms involved in the anti-depressant effects of exercise would not only provide a better insight into a possible causal association but also should be helpful in the future use of exercise as an adjunct therapy in the treatment of depression. More studies are needed therefore to examine the potential physiological and psychological mechanisms (Dunn, Trivedi and O'Neil, 2001; Fox, 1999; Landers and Arent, 2001), some of which are briefly discussed in the following sections.

The Endorphin Hypothesis

Available research evidence suggests that exercise elevates blood-plasma endorphin levels (Carr et al., 1981; Bortz, 1982; Moore, 1982). In spite of this consistent evidence about elevated levels of plasma endorphin levels after exercise, the hypothesis that this exercise-produced endorphin cause an improvement in depression remains untenable. For example, Morgan (1985) pointed out that even

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if endorphin levels in the central and peripheral nervous systems do not vary, changes in peripheral opiate levels, reflecting adrenal gland activity, could at least theoretically affect our emotional state. This view was later supported by Johnsgard (1989), according to whom endorphins may not play a central role in depression.

The Monoamine Hypothesis

As the endorphin hypothesis remains questionable, there are several other neurotransmitters that are being investigated. For example, catecholamine and serotonin have been reported to be central in depression (Morgan, 1985; Ransford, 1982). In summary, it is not clear what happens to monoamine levels in the human brain after exercise. Indirect evidence suggests that exercise ameliorates depression by stimulating the monoamine system. However, more research is needed to establish this relationship.

Self Efficacy Hypothesis

Self efficacy is the level of confidence one feels to meet the challenge at hand. It has been proposed as one mechanism by which exercise may reduce depression. It refers to the belief that one has the required skills to complete a task as well as the confidence that the task can actually be completed with the expected outcome. Efficacy beliefs direct choice of behaviour, selected goals, persistence at a task, motivation and effort expectations of success and affective response (Bandura, 1997). It is suggested that healthy normal individuals can regulate goal-directed behaviours and use regulatory strategies for the thoughts, feelings and emotions (Mirin and Sederer, 1994). This idea of self regulation led to several investigations of the concept of coping self efficacy. Beliefs of people about their ability to control a challenging situation and regulate their response to the situation is a primary determinant of how they will respond. A low sense of self control or coping efficacy can create anxiety in people when they face situations, especially if they have little confidence to obtain the expected outcomes. This low sense of efficacy appears to lead people to negative self evaluations, negative ruminations, and faulty styles of thinking. Moreover, depressed people often blame themselves for negative life events which can worsen and prolong their depression (Kavanagh and Wilson, 1989).

Different factors influence the development of self-efficacy beliefs. Exercise appears to provide an effective medium to promote efficacy beliefs by providing and improving meaningful mastery experience. For an intervention to increase coping self efficacy, it must teach the individual how to self monitor behaviours, set goals, and utilize social support to maintain the desired behaviours (Bandura, 1997).

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Learning how to monitor exercise behaviours, set exercise goals and use support from the instructors and others can contribute to feelings of mastery. Therefore, it is possible that the antidepressant properties of exercise are related to stronger feelings of efficacy caused by mastery experience (Beniamini, Rubenstein, Zaichkowsky and Crim, 1997; Bandura, 1997).

Distraction Hypothesis

The concept of distraction has been used as a possible explanation for the antidepressant effects of exercise. For example, some researchers (Gleser and Mandleberg, 1990; Leith, 1994) suggested that physical activity serves as a distraction from worries, anxiety and stressful thoughts. A theory of depression that is conceptually related is the response styles theory (Bandura, 1997). This theory discusses two different dispositional ways by which individuals respond to feelings of depression and how these differing responses can affect the severity and duration of a depressive episode. Rumination is a response style that involves the tendency to passively and repeatedly focus on one's negative feelings and their consequences, whereas distraction refers to a response style in which the individual becomes busy in an activity and focuses on something other than the depressed mood. Rumination appears to have a negative influence on the cause of depression. It may lead to negative thoughts and attributions about the self, past, present, and future which can prolong the depressed mood (Lyubomirsky and Nolen-Hoeksema, 1995). If people engage in negative thought instead of activities to solve their problems, they may suffer from prolonged bouts of depression. Moreover, ruminating on one's depression may prevent the individual from behaving in a way that produces positive reinforcement and promotes one's sense of control. Without such opportunities, the depressed person may experience feelings of helplessness, lowered self esteem and expectancies for the future and a lack of motivation (Bandura, 1997).

Research in this area has shown that women spend more time ruminating than men and that men usually use distraction more than women. It has also been shown that individuals who ruminate generally have more severe and longer lasting episodes of depression than those who use distraction as a response style (Just and Alloy, 1997; Bandura, 1997). It therefore appears that a distraction response style appears to be associated with a more positive outcome for people suffering from depression (Nolen-Hoeksema, and Morrow, 1991). Not all activities, however, are distracting. An effective distracting activity engages the individual and provides opportunities for positive reinforcement. The very nature of exercise makes it a potentially distracting activity. When exercising, for example, people focus on exercise goals or on somatic changes like breathing, heart rate, fatigue or pain (Leith, 1994). One of the authors of this paper (Venkateswarlu) used distraction as a strategy on his distance runners during training to delay fatigue and to endure pain. It was found that the athletes were more motivated as they completed their schedule on time and achieved performance targets. Thus, it appears that exercise offers the opportunity for positive reinforcement as exercise goals are met, daily workouts become less painful and fatiguing and much social support is received for taking a proactive role in the management of symptoms.

Recommendations

On the basis of this critical review, the following recommendations are made for future research and practice.

1. Although there is mounting evidence on the association between exercise and reduction in depression, the evidence is not conclusive. It is therefore suggested that more studies should be conducted with strict controls on the different modes of exercise and the severity and duration of depression.
2. As there are no negative effects of exercise training on depression, it is recommended that exercise may be used as an adjunct treatment for depression.
3. Of all the types of exercise training, walking and low intensity aerobic exercise training appear to be most beneficial to depressive patients. Therefore these forms of exercised are recommended for these patients.
4. One of the best ways of deriving optimal benefits of exercise training is by using distraction strategy. It is therefore suggested that people using low intensity, long duration exercise should use distraction as a strategy to delay fatigue, decrease the duration of depressive episode and to reduce the potential for injury.

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