

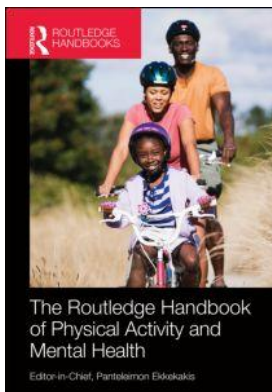
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### **Potential Psychological Mechanisms Underlying the Exercise and Depression Relationship**

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# 9

## POTENTIAL PSYCHOLOGICAL MECHANISMS UNDERLYING THE EXERCISE AND DEPRESSION RELATIONSHIP

*Lynette L. Craft*

Understanding the ways in which exercise reduces the symptoms of clinical depression is an important step in determining the role for exercise in the standard of care for depression treatment. It can be argued that medicine is filled with examples of treatments coming well before the understanding of how the treatments worked. Antidepressant medications, for example, were being used with patients long before scientists and clinicians had a clear understanding of precisely how they exerted their antidepressant effects (Mayze, 2012). However, there will remain scientists, clinicians, and patients themselves who question the utility of incorporating exercise into the treatment of depression until the mechanisms underlying this relationship have been elucidated. Further, in order to develop the most effective exercise interventions, it is important to understand how exercise elicits its effect.

Several hypotheses have been proposed to explain the mechanisms by which exercise reduces depressive symptoms. These hypotheses are both psychological and neurobiological in nature. This chapter will focus on the potential psychological mechanisms, while the following chapter will cover proposed neurobiological mechanisms. Unfortunately, there is insufficient evidence at this time to support or refute most of the psychological mechanisms that have been proposed. Thus, this chapter will highlight the research in this area and suggest additional mechanisms for future researchers to consider.

### **The self-efficacy hypothesis**

One of the most well-known psychological mechanisms proposed to explain the exercise–depression relationship is the enhancement of self-efficacy. Self-efficacy refers to the belief that one possesses the necessary skills to complete a task, as well as the confidence that the task can actually be completed with the desired outcome obtained. Depressed individuals often feel inefficacious to bring about positive desired outcomes in their lives and have low efficacy to cope with the symptoms of their depression (Bandura, 1997). This can lead to negative self-evaluation, negative ruminations, and faulty styles of thinking. Conversely, enhanced feelings of self-efficacy are associated with reduced catecholamine response to stress, lower perceived vulnerability to threat, reduced anxiety, and increased cognitive control (Bandura, 1997).

It is generally thought that there are four primary sources of information that influence an individual's perceptions of self-efficacy. These include mastery experiences, vicarious experience,

verbal persuasion, and physiological and affective states. As an example, it has been suggested that exercise may enhance self-efficacy based on its ability to provide the individual with a meaningful mastery experience. Specifically, exercise programs teach an important health-related skill, utilization of the skill to achieve personal goals, and to attribute improved mental health to the mastery and use of the skills. A second example is that observing someone similar to oneself learn to exercise, and to utilize exercise as a means to manage symptoms, may increase one's own self-efficacy to use exercise for symptom management (i.e., via vicarious experience).

Research examining the association between exercise and self-efficacy in the general population has focused predominantly on the enhancement of overall self-efficacy following exercise participation. That is, studies have examined whether involvement in a program of regular exercise leads to either enhanced feelings of overall confidence or increased feelings of self-efficacy to engage in exercise behaviors. This has been examined in a variety of clinical samples (e.g., cancer survivors, persons with HIV, persons with multiple sclerosis) and healthy volunteers (Elavsky et al., 2005; Fillipas, Oldmeadow, Bailey, & Cherry, 2006; Hughes et al., 2010; Motl & Snook, 2008). In general, these studies find that exercise is associated with improved feelings of self-efficacy pre- to post-intervention and this, in turn, is associated with better quality of life (QOL). In addition, many of these exercise intervention studies have found that enhanced feelings of exercise self-efficacy, following an exercise intervention, are predictive of increased time spent in physical activity.

While it is highly relevant that exercise promotes enhanced feelings of efficacy, the aforementioned studies did not address the relationships of exercise and self-efficacy with depression. Clinical depression has received far less attention in the exercise and self-efficacy literature. Few studies have actually examined the effects of exercise interventions on self-efficacy among those with depression and the findings of these studies have been equivocal as to whether exercise leads to an enhancement of generalized feelings of efficacy (Brown, Welsh, & Labbe, 1992; Martinsen, Hoffart, & Solberg, 1989; Shin, Kang, Park, & Heitkemper, 2009; Singh et al., 2005).

While generalized feelings of self-efficacy are important, it is also essential that we understand whether exercise leads to an enhanced feeling of ability to cope with or manage one's symptoms of depression (i.e., coping self-efficacy). One longitudinal cross-sectional study was conducted to examine the relationships among physical activity, exercise coping, and depression (Harris, Cronkite, & Moos, 2006). Depressed patients ( $N = 452$ ) were followed for 10 years and completed assessments at study entry, and 1, 4, and 10 years post-entry. A limited assessment of physical activity was utilized, with participants indicating whether or not they engaged in swimming, tennis, or long hikes or walks with family or friends during the past month. Exercise coping, or how often the person exercised more to cope with an important problem or stressful event (i.e., a form of coping self-efficacy), as well as the presence of stressful life events and medical conditions were assessed. Results indicated that every one increment increase in physical activity was associated with a 2.24-point reduction in depression. Further, exercise coping was associated with a 1.23-point reduction in depression. Each medical condition was associated with a 3.00-point increase in depression, but every increment increase in physical activity decreased depression by .90 points and exercise coping decreased depression by .67 points. Finally, each negative life event increased depression by ~3.50 points, but every increment in physical activity decreased this by .89 points and exercise coping decreased depression by .66 points. Therefore, physical activity and exercise coping both appear to be helpful in managing life stressors and medical conditions, providing some support for the role of self-efficacy as a mechanism to explain the exercise–depression relationship.

There is a paucity of exercise intervention studies that have examined the potential role of coping self-efficacy in both depressed and non-depressed samples. For example, we conducted

a study to examine the relationship between involvement in an exercise program and enhanced feelings of coping self-efficacy (i.e., confidence to cope with one's symptoms of depression) in depressed women (Craft, 2005). Women (N = 19) with moderate depression, taking antidepressant medications, were assigned to either a 9-week moderate-intensity aerobic exercise intervention or a control group. Those in the intervention arm exercised three times/week, at 50–75% heart rate reserve, for 30 minutes. We found that coping self-efficacy was significantly higher in the exercise group (as compared to controls) at 3 weeks and this significant difference between groups was maintained at 9 weeks. Further, coping self-efficacy was inversely related to and the best predictor of depressive symptoms at both 3 and 9 weeks, after controlling for baseline values of depression and coping self-efficacy (Craft, 2005).

Surkan and colleagues (Surkan, Gottlieb, McCormick, Hunt, & Peterson, 2012) conducted a randomized controlled trial to examine the effect of a healthy lifestyle intervention (aimed at improving dietary and physical activity behaviors) on depressive symptoms in 679 low-income postpartum women. While not all women were experiencing depressive symptoms at baseline, the authors report that improvement in self-efficacy score for at least one health behavior (e.g., physical activity, eat more fruits and vegetables) appeared to mediate the overall effect of the intervention on depressive symptoms. Conversely, a study implementing an exercise and educational program among non-depressed persons with rheumatoid arthritis (N = 34) found no benefit with respect to coping self-efficacy. Specifically, the exercise intervention increased aerobic capacity and muscle strength but there were no improvements in self-efficacy for arthritis disease management (Breedland, van Scheppingen, Leijnsma, Verheij-Jansen, & van Weert, 2011).

While self-efficacy is by far the most widely studied of the proposed psychological mechanisms, the majority of studies in this area have examined relationships between exercise and overall feelings of efficacy, rather than examining the mediating role of self-efficacy in the exercise–depression relationship. Consequently, although the enhancement of self-efficacy to lower depressive symptoms fits within current models of depression treatment, we have insufficient evidence at this time to be convinced that the self-efficacy hypothesis is valid.

### **The affect regulation hypothesis**

The use of exercise to regulate affect may play a key role in how exercise alleviates depressive symptoms. Acute or individual bouts of exercise can reduce negative mood states and enhance positive mood states (Miller, Bartholomew, & Springer, 2005). Thus, exercise may act to provide temporary depressive symptom relief. Bartholomew and colleagues (Bartholomew, Morrison, & Ciccolo, 2005) found that a single bout of moderate-intensity exercise significantly improved negative aspects of mood and elevated feelings of general well-being and vigor in adults diagnosed with major depressive disorder (MDD). Participants (N = 40) were randomly assigned to either aerobic exercise for 30 minutes or to a 30-minute period of quiet rest. Mood and well-being were assessed 5 minutes before exercise or control and 5, 30, and 60 minutes following. Both conditions were associated with sustained improvements in mood in those with MDD. However, the exercise condition was also associated with significant and sustained improvements in feelings of well-being and vigor. Thus, acute exercise bouts may lessen depressive symptoms by allowing patients a means to more immediately regulate their mood and to experience brief periods of relief from their depression.

A second study has examined the effects of an acute bout of exercise on mood in individuals diagnosed with MDD or minor depressive disorder (Weinstein, Deuster, Francis, Beadling, & Kop, 2010). In this study, 14 individuals with depression and 16 controls (without a diagnosis of depression) engaged in an acute bout of exercise following a 30-minute rest period. The

exercise bout was conducted at 70–85% of  $\dot{V}O_2$ max. Mood assessments were conducted prior to the exercise, immediately post-exercise, and 30 minutes after completion of exercise. Mood was assessed with the Profile of Mood States–Short Form inventory. Results indicated a significant reduction in depressed mood immediately post-exercise in participants with depression as compared to the control group, who had no change in depressed mood. Further, no group differences were found for fatigue or vigor immediately post-exercise. However, at 30 minutes following exercise, participants with depression experienced an increase in depressed mood, decreased vigor, and increased fatigue compared to baseline levels. Interestingly, severity of depression (as assessed by the Beck Depression Inventory–II at baseline) was significantly related to increases in depressed mood and fatigue at the 30 minutes post-exercise assessment. Thus, while an acute bout of exercise provided a mood benefit immediately post-exercise for those with depression, this mood benefit appears to be short-lived for some participants.

More work is needed with respect to this hypothesis. If affect regulation plays a role in the exercise–depression relationship, this has important implications for the timing and length of exercise interventions. Further, utilizing short, acute bouts of activity at multiple times during the day may be particularly important as those with depression often choose less healthy mood management strategies such as alcohol, tobacco, and drugs (Bartholomew, Morrison, & Ciccolo, 2005). It will be important for researchers to further examine the role that symptom severity plays in the effectiveness of acute exercise to manage mood and to investigate other person characteristics, such as age or race, that may influence the psychological response to an exercise bout (Hasson et al., 2011).

### **The distraction hypothesis**

The distraction hypothesis has been commonly described in the exercise and depression literature since the 1970s (Barhrke & Morgan, 1978). This hypothesis proposes that exercise serves as a distraction from worries, stress, and depressive thoughts. Thus, distraction is a response style (Nolen-Hoeksema, 1991) or way of coping with depression in which the individual engages in distracting activities as a means to focus on something other than their depressed mood. Exercise has been compared to other distracting activities such as social contact, health education, relaxation, and assertiveness training, with mixed results (Doyle, Chambless, & Beutler, 1983; Klein et al., 1985; McNeil, LeBlanc, & Joyner, 1991; Singh, Clements, & Fiatarone, 1997). That is, exercise is superior to some of these activities and similar to others in its ability to alleviate depressive symptoms.

In our study of coping self-efficacy described previously (Craft, 2005), we also examined distraction as a potential mechanism underlying the exercise–depression relationship. In that study, we administered the Response Styles Questionnaire (RSQ) in order to assess an individual's tendency to use distraction as a coping mechanism, as opposed to using rumination (passively and repeatedly focusing on one's depressive feelings). Following the 9-week exercise intervention, both exercisers and control group members reported a reduction in their use of rumination but neither group reported an increase in their use of distraction. Thus, the data did not support our prediction that exercise would increase the use of distraction as a response style and that a distraction response style would be associated with lower depression scores among those in the exercise group.

The utility of this hypothesis remains unclear. Exercise may be a particularly distracting task when first being learned. Initially, individuals may be focused on somatic responses such as heart rate, breathing, fatigue, or sore muscles, as well as achieving exercise goals (Leith, 1994). However, once an activity is well learned, some might argue that one's mind is at liberty to

problem solve or to further analyze one's troubles. Consequently, this hypothesis, in particular, may apply for some individuals at certain stages of an exercise program but have less relevance at other stages of exercise involvement.

### **Behavioral activation hypothesis**

Behavioral activation is a psychotherapeutic process that encourages structured attempts at increases in behaviors that are likely to provide the patient with the opportunity for positive reinforcement and corresponding improvements in thoughts, mood, and quality of life (Hopko, Lejuez, Ruggiero, & Eifert, 2003). Depressed individuals often engage in maladaptive coping strategies such as inactivity and withdrawal. Within the process of behavioral activation, individuals are asked to begin replacing their inactive and passive activities with more active, enjoyable, and pleasurable activities. This theory would suggest that exercise is an action that is inconsistent with the natural tendencies associated with depression. Thus, it is thought that exercise represents an activity that has the potential to be rewarding and enjoyable, providing a sense of accomplishment. Consequently, depressive symptoms may be alleviated as the individual begins to replace passive activities with exercise and other more enjoyable activities.

This therapeutic approach involves teaching patients to formulate and accomplish behavioral goals. Further, in some types of behavioral activation therapy, the patient is asked to systematically increase the frequency of healthy behaviors (Hopko et al., 2003). Therapists may use a variety of behavioral strategies such as self-monitoring of activities and mood, activity scheduling, problem solving, social skill training, reward, and persuasion (Dimidjian, Barrera, Martell, Munoz, & Lewinsohn, 2011). For example, the patient may be asked to self-monitor his daily activities and then to identify relevant behavioral goals in major life areas in a hierarchical fashion (Hopko et al., 2003). This work often includes homework assignments, the use of self-identified rewards when goals are met, and opportunities for positive reinforcement. Over time, replacing depressive behaviors with activities and behaviors that are incompatible with depression should also result in a change in thoughts and mood (Dimidjian et al., 2011; Hopko et al., 2003).

There is no research to date that has explicitly tested this hypothesis within the context of exercise as a treatment for depression. However, these therapeutic processes are, in many ways, quite similar to what occurs within the context of an exercise training program. For example, exercise programs for depression often start with a self-monitoring exercise so that the study participant can understand the extent to which they currently engage in movement throughout the day. This is often accomplished with an activity log or a pedometer. Long-term goals for the exercise program are often established (e.g., working up to 30–45 min/week of moderate-intensity exercise on 5 or more days/week), while working collaboratively with the participant to set shorter-term weekly goals. In addition, participants are often asked to rate their mood during and after their exercise bouts so that they become more cognitively aware of how exercise affects mood. Participants are also generally encouraged to self-identify some personally meaningful reward that they will provide themselves should they meet their exercise goals. Finally, within the context of working with the exercise leader, there are also ample opportunities for positive feedback and positive social interactions.

Thus, an exercise program contains many of the same components of behavioral activation. Consequently, some may argue that exercise is simply a form of behavioral activation and, as a result, causes antidepressant benefits in a manner similar to that of behavioral activation. Studies are needed that directly compare exercise to behavioral activation and to other pleasant, reinforcing activities in individuals with depression, as well as studies that examine the importance of the “process” of learning to exercise (i.e., self-monitoring, goal setting, achieving exercise

goals). It may be that the process of engaging in an exercise program and the cognitive behavioral characteristics of the program are as important in alleviating depressive symptoms as is the physical exercise that is completed.

As described, there is limited research examining the psychological mechanisms that have frequently been proposed during the past three decades. Many psychological mechanisms that have been proposed or mentioned in the literature have only one study, or in many cases, no studies empirically examining their worth. Consequently, it is an understatement to say that more work is needed.

To elucidate new, potentially relevant mechanisms, future researchers may find it helpful to more closely examine current evidence-based psychological therapies for depression. There are likely many commonalities between psychotherapy components and exercise programs. Understanding these commonalities may provide insight into mechanisms of treatment action. There has also been much written about the importance of the therapeutic relationship with respect to successful psychotherapy treatment outcomes. Primary aspects of the therapeutic relationship that have been identified as contributing to treatment success are goal consensus and collaboration. Goal consensus involves the patient and therapist coming to agreement about treatment goals and the processes by which the two will work together to achieve these goals. Collaboration refers to the process of the therapist and client working together to achieve the treatment goals (Swift & Callahan, 2009; Tryon & Winograd, 2011). Notably, the relationship between the exercise leader and depressed participant may also involve these specific therapeutic features as exercise goals are set and the dyad work collaboratively to achieve goals. As a result, these aspects of the therapeutic alliance may be important, independent of the actual exercise activity. Therefore, examining the ways in which psychotherapy “works” to alleviate depression may, in turn, allow us to postulate new mechanisms for how exercise effectively alleviates depressive symptoms.

### Summary

In summary, more research is needed to determine which, if any, of the mechanisms described in this chapter underlie the effect of exercise on depression. It is highly likely that a combination of biological, psychological, and sociological factors influence the relationship between exercise and depression. This is consistent with current treatments for depression in which the effects of pharmacotherapy and psychotherapy on depression are often additive and address biological, psychological, and sociological aspects of the patient. Orlinsky and colleagues (Orlinsky, Ronnestad, & Willutzki, 2004), in their discussion of successful psychotherapy processes, state that “Both relationship variables and intervention procedures, patient participation and therapist influences, contribute jointly and variously to shaping the outcome of therapy” (p. 363). This is likely to also be true with respect to the effect of an exercise program on depressive symptoms. Future researchers must continue to identify and understand the various contributing mechanisms. Until we gain a better understanding of how exercise alleviates the symptoms of depression, we will likely continue to encounter difficulty in achieving a permanent place for exercise in mainstream depression treatment.

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