Exercise as Therapy for Depression: A Review of the Positive Psychosocial and Psychobiological Effects of Physical Activity

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Depression has been conceptualized in two separate ways. Some define the phenomenon by a unique array of psychological abnormalities (a social and behavioural profile). On the other hand, depression can also be described as a quantifiable diseased state of the brain that may be cured using a biological therapy or pharmaceutical. Neither one of these definitions is incorrect; rather, they each describe different aspects of this form of mental illness. This duality inherent to understanding depression makes light of the sparse assemblage of literature that exists concerning such a socially, psychologically, and biologically complex phenomenon. Research has shown that the therapeutic benefits of exercise offer treatment for both the psychosocial and biological effects of depression. A more unified research perspective that looks for a coincidence of the social with the biological may allow for steps forward in understanding mental illness and disease.

Keywords: physical activity, mental disorder, psychological therapy, depression

Depression appears to have two radically different definitions in current literature. Some authors use the term to describe a condition that constitutes legitimate psychological dysregulation (Ilardi & Craighead, 1994) as there is evidence of dysfunction in self-perception, interpersonal behavior, coping skills, and cognition (Lewinsohn et al., 1997). However, in a neurological context, depression can also describe a biological illness — one that can rob patients of their restorative sleep, proper energy levels, and attentive brain power (Ilardi & Craighead, 1994). This contrast reflects the duality that appears to define depression and corresponds to the dual therapeutic effects of exercise for patients with depression (which appear to be both psychosocial and psychobiological).

To accurately investigate this relationship between exercise and depression, it is important to consider that exercise is a broad term that can encompass physical activities of various intensities and techniques, and consequently have varying effects on human behaviour and biology. However, in this review, aerobic (cardiovascular) training studies are described, as opposed to more resistance-based or weight-training exercise. This is because aerobic training is thought to provide the necessary increase in oxygen uptake that would initiate psychological change (King et al., 1989). The influence of intensity or type of activity on psychological outcomes remains unclear. Additionally, frequency of exercise was not considered in this analysis, however, all studies had participants (healthy controls and patients with varying degrees of depression) who engaged in exercise at least once per week.

The Psychosocial Consequences of Exercise

Societies can attribute great merit to those who are in proper physical and mental health, depending upon one’s particular sociocultural sphere (Hayes & Ross, 1986). As such, those who are not in good health (including depressed patients) may be subject to psychological distress and negative evaluations such as self-stigmatization, and labelling the self as “sick” or an “other” (Zechner & Gill, 2016). In a psychosocial context, current literature suggests that exercise can provide an alleviating
influence in two distinct ways: helping patients develop standards that promote self-worth and increasing personal self-efficacy (Tice & Bratslavsky, 2000; DeBono et al., 2011; Kangas et al., 2015). Self-worth is typically described as an estimate or opinion of one’s self, whereas self-efficacy refers to a belief in one’s ability to succeed in specific situations or environments (Bandura & Wessels, 1997).

**Exercise and the Development of Social Standards**

Illness is more common in some groups than others, and consequently, it is less likely to be considered atypical or abnormal in these contexts (Zola, 1966). In fact, it is more likely to be overlooked, ignored, and even looked upon as natural (Zola, 1966). By creating a unique social environment that may stimulate increases in self-worth based on improvements in physical conditioning, exercise can allow those with depression to define themselves, in part, by a tangible and self-controlled level of fitness rather than by their mental illness. In this context, increases in self-worth are thought to occur as a result of the standards used in exercise that define success for the participant (DiLorenzo et al., 1999). Standards are socially constructed ideas that are used to measure, compare, or evaluate oneself and are inherent to the concept of self-worth (Tice & Bratslavsky, 2000). When individuals seek control over themselves or their lives, they invoke various standards (Tice & Bratslavsky, 2000). Therefore, by affording a diverse set of quantitative fitness measures (e.g., strength, endurance, speed, agility, and power), exercise has been shown to construct shift depressed patients’ self-worth from a disease-centered internal perspective to a goal-driven external perspective that focuses on achieving or improving these fitness standards (DiLorenzo et al., 1999).

Without these measures of fitness that can promote increases in self-worth, it is possible that individuals with depression could experience two types of “self-control failure”: under-regulation or mis-regulation (Baumeister et al., 1994). According to conventional psychology, under-regulation is the lack of ability to control one’s negative self-evaluation (Baumeister et al., 1994). Mis-regulation, on the other hand, would constitute the use of an ineffective strategy to alleviate harmful self-perception (Baumeister et al., 1994). In either case, the exercise community is defined by a set of shared standards and fitness goals, and provides considerable self-control resources, making it less likely for those with depression to see increases in negative affects and fatigue (Iso-Ahola, 2013). Moreover, research by DeBono, Schmueli, and Muraven (2011) suggests that if self-control resources decrease, individuals engaging in exercise may experience ego depletion that reduces the likelihood of exercise adherence and leads to more problematic behaviours. According to the authors, this depletion may occur because self-worth is a limited resource that can decrease following increases in negative self-evaluation (DeBono, Schmueli, & Muraven, 2011). Nevertheless, these detrimental failures in self-control seem to be well accommodated by the wide set of tangible standards available to depressed individuals through exercise, which reduce negative self-perception and thus help to maintain self-worth.

**Exercise and the Development of Self-Efficacy**

In addition to this array of standards that may help depressed patients form a tangible sense of self, exercise also appears to be related to improvements in self-efficacy (Bodin & Martinsen, 2004). Bodin and Martinsen (2004) state that “depressed individuals have a negative cognitive shift, which leads to positive
EXERCISE AS THERAPY FOR THE DEPRESSED

information being filtered out of their [consciousness]” (Bodin & Martinsen, 2004, p. 7). This event leaves the mind in a confused and apathetic state, which is detrimental to the formation of any concrete positive sense of self (Bodin & Martinsen, 2004). Although the antidepressant effects of exercise are still not fully understood, multiple authors have proposed that self-efficacy may mediate this relationship because it reliably increases positive behaviours (Bandura & Wessels, 1997; Zeiss, Lewinsohn, & Muñoz, 1979). Recent research by Kangas and colleagues (2015) also showed that self-efficacy is noticeably higher in depressed participants on days when they exercise, as opposed to days when they do not (Kangas et al., 2015). Interestingly, those with higher levels of depressive symptoms were found to have self-efficacy levels that were noticeably more sensitive to whether exercise occurred or not (Kangas et al., 2015). Therefore, despite the benefits of exercise, it appears that as depression worsens, patients have an increasingly difficult time sustaining regular physical activity because they experience comparatively low levels of self-efficacy on off-days. Future studies should investigate the development of programs that promote and help patients with depression to engage regularly in exercise. By doing so, the positive effects of maintaining good fitness, such as increased self-efficacy, may allow the development of a more positive outlook.

In opposition to these findings, psychiatric researchers have posited that the frequency or duration of exercise has little effect on the level of depression experienced by patients. For example, if one is engaging in a large amount of physical activity at work, it does not seem to have any psychological benefits (Harvey, Hotopf, Øverland, & Mykletun, 2010). These authors state that the context of exercise has a larger influence. Therefore, there is something specific about engaging leisure time that creates psychological benefits, as opposed to the physical activity itself (Harvey et al., 2010). Moreover, current research suggests a weak dose-response relationship for exercise; few studies have shown increased psychological benefits for depressed patients engaging in physical activity beyond two hours a week (Rivenes, Harvey, & Mykletun, 2009).

Indeed, the environment and length of exercise engagement were not addressed by any of the previously mentioned studies that investigated the positive psychosocial implications of physical activity on depression. However, length of exercise in this case may be irrelevant because patients engaging in exercise bouts below the two-hour length experienced the benefits. Furthermore, even though exercise context was not mentioned in the psychosocial studies presented, all participants adhered to study guidelines on their own free time (coincident with the findings that exercise during leisure time is beneficial). Thus, the positive psychosocial benefits incurred by depressed individuals engaging in consistent physical activity remain well supported (Harvey, Hotopf, Øverland, & Mykletun, 2010; Rivenes, Harvey, & Mykletun, 2009).

The Psychobiological Influence of Exercise

There exists an internal perspective that suggests an individual’s interpretation of social interaction to be of great importance (Merleau-Ponty, 2013). As such, it is thought that patients with depression self-regulate (internally) what their condition means to them (Merleau-Ponty, 2013). Thus, although many sociocultural spheres have different definitions of health and depression, the effect of this mental illness on psychological well-being may be relatively constant as depression is self-regulated. Current research seems to suggest that specific biological changes, through exercise, have the power to inherently shift the depressed patient’s ability to perceive the self in a more positive
light, and thus work confidently towards full recovery (Daley, 2000).

**Neurochemical Effects of Exercise**

There are various hypotheses that explain how exercise (biologically) improves psychological outcomes. Exercise has been shown to have an effect on the neurochemical environment of the brain, namely on serotonin, which is known to help elevate mood (DiLorenzo et al., 1999). Moreover, exercise is well documented to cause endorphin and norepinephrine release, which regulate feelings of well-being and euphoria (Kaur et al., 2014). A recent study by Mata and colleagues (2010) surveyed a group of 82 adolescent girls with no current or lifetime history of psychopathology, and they discovered that brain-derived neurotrophic factor genotype moderates the protective effect of exercise on depressive symptoms. Interestingly, those with a BDNF gene polymorphism (which increases risk for depression) saw a protective effect of physical activity on the development of depressive symptoms, as opposed to those without the polymorphism who saw no protective effect (Mata et al. 2010). It is therefore likely that exercise affords the largest benefits to those with the most severe depressive symptoms and/or risk for depression, a conclusion that is supported by prior research (Browman, 1981).

The subtle neurochemical changes that occur in depressed patients have also been linked to largescale degenerative effects on the anatomical structure of the brain (Gujral et al., 2017). More specifically, meta-analytic evidence from Gujral and colleagues (2017) suggests that patients with depression may experience volumetric reductions in the grey matter of the prefrontal cortex, amygdala, striatum, hippocampus, and anterior cingulate cortex. These authors conclude that exercise may exhibit anti-depressant effects by stimulating increases in regional brain volume through the upregulation of downstream cell proliferation pathways, hypothalamic-pituitary-adrenal axis activity, and angiogenesis (Gujral et al., 2017; Mahar et al., 2014; Sahay & Hen, 2007). By providing this chemical basis for clarity in thought, exercise may allow for a positive shift in internal perspective that helps depressed patients (DiLorenzo et al., 1999); however, neurobiological research still remains unclear as to the connection between the physiological and anatomical changes that occur following exercise, and the decreased depressive symptoms seen in patients (Gujral et al., 2017).

Lastly, patients with depression have also shown deficits in white matter connectivity. Additional meta-analytic evidence suggests that exercise may improve the integrity of white matter in the depressed brain, especially within the corpus callosum and cingulum (Liao et al., 2013). The corpus callosum is essential for interhemispheric communication, which may explain some of the anti-depressant effects of exercise in this context (Wise et al., 2016). Therefore, through effects on multiple neurobiological systems, exercise may be able to reduce various medical morbidities associated with depression (Southwick et al., 2005).

Overall, the varied neurochemical responses following exercise appear to partially restore an abnormal neural environment to homeostatic conditions (Gujral et al., 2017; Mahar et al., 2014).

**Systemic Biological Effects of Exercise**

In addition to these neurochemical effects, it has been suggested that improvements in psychological outcome measures have occurred because of changes in body composition, such as weight loss and increased muscle mass (DiLorenzo et al., 1999). In addition to anthropometric changes, there are other rather under-represented health benefits of exercise on those with depression, including a reduction in cardiovascular risk factors (Kerling et al., 2005).
et al., 2015; Wei, Karim, Lin & Mizuno., 2018). Since many patients with depression also have poor cardiovascular health, exercise is an excellent intervention not only to improve physical fitness, but to improve the capacity for normal psychological function due to proper blood flow (Kerling et al., 2015; Wei et al., 2018).

This conclusion does come with a caveat, as depressed patients have a much more difficult time initially starting to become involved with exercise compared to healthy participants (Zechner & Gill, 2016). With more evidence to support the benefits of exercise for mental health problems, there may be opportunities to provide programs to support teaching and engagement activities in exercise that may address this difficulty for those who are depressed (Haller et al., 2018). Nevertheless, research posits that these more largescale biological changes following exercise may result in quantifiable health changes that assist in the recovery from debilitating illness (DiLorenzo et al., 1999; Gujral et al., 2017; Kerling et al., 2015).

Due to the lack of research into the molecular mechanisms underlying many mental illnesses (including depression), there remains a large possibility for confounding influences within the aforementioned relationships (Cooney, Dwan & Mead., 2014). As such, the optimal type, intensity, frequency, and duration of exercise to treat depression remains uncertain (Cooney et al., 2013). This does not mean that the relationship between these two variables is nonexistent; rather, it suggests that healthcare professionals should be meticulous in their approach to diagnosis or recommendation of exercise to patients with depression. Not all individuals will respond in the same way to exercise, nor will the effects be as effective for their state of depression (Moussavi et al., 2007). Without these patient-specific details, prescribing exercise regiments for depression might seem unrealistic for regimented clinical implementation. However, this lack of specificity does not provide grounds to neglect exercise as treatment, nor does it suggest overly harmful side-effects or contraindications (Blumenthal et al., 1999). In the same way that chemotherapeutic drugs have been designated permissible treatments for cancer despite their broad scale side effects, so too can exercise be prescribed without a fully detailed scientific rationale of its acute effects on the brains and bodies of depressed patients (Blumenthal et al., 1999). Exercise does pose certain risks such as physical trauma due to improper form or technique (e.g., muscle sprains, strains or bone fractures) and dehydration (Ristolainen et al., 2019; Wohlfert & Miller, 2019). However, the psychosocial and biological benefits seem to outweigh the risks, especially in the context of educational programs that can help patients with depression exercise safely and effectively. Therefore, regular exercise remains a functional treatment option for depression, not only based on a lack of serious side effects, but importantly, on its ability to promote tangible standards for success, increase self-efficacy and assist in the regulation of homeostasis by altering multiple biological systems.

Conclusion

By providing an overview of both the positive psychosocial and psychobiological effects of exercise on depression, the present review makes light of the duality inherent to the current understanding of depression; one that can look for separate solutions either within the mind, or within the body (Banner, 2013). Given the research presented, perhaps these two fields of psychology and biology should no longer remain as distanced. Moreover, current research lacks an appropriate consideration of all population demographics, the effects of different forms and intensities of exercise on levels of depression, and does not appropriately account
for long-term changes in psychological well-being following exercise. As such, more detailed investigations into the psychological and biological consequences of exercise that address shortcomings of this kind may be the cornerstone of future research that seeks to effectively treat the multifaceted afflictions of patients with depression.

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EXERCISE AS THERAPY FOR THE DEPRESSED


