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### Depressed, Low Self-Esteem: What Can Exercise Do For You?

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#### ABSTRACT

The purpose of this paper is to review the current literature to examine the effects of various forms of physical activity upon mental health. A literature review was conducted to examine specific findings of the relationship between exercise (aerobic and anaerobic) and psychological well being. It was found that aerobic exercise performed at a moderate intensity produces significantly greater positive psychological outcomes than does either high intensity aerobic exercise or anaerobic exercise. Additionally, no specific differences were discovered between various methods of aerobic exercise as long as it is conducted for over 20 minutes continuously. Low impact aerobic exercise, such as yoga or meditation was also found to have positive effects on mental health. Various mechanisms underlying the mood boosting effects of exercise are also briefly examined.

#### INTRODUCTION

Mental health and physical health are very closely tied together, and each can exert a significant effect on the other. Mental health can be positively affected by physical activity and exercise, and conversely, individuals involved in physical rehabilitation adhere to their treatment programs better and make greater advances in treatment when they have stable, positive mental health.<sup>1</sup> A recent study confirmed that people with poorer mental health report more physical and somatic complaints and limitations.<sup>2</sup> It is becoming increasingly more evident that mental health and physical activity are intimately tied together and much research has been conducted on the subject of the relationship between these two variables. However, the best forms of exercise for improving mental health and the specific effects of different exercises has yet to be determined.<sup>3-5</sup> This paper seeks to examine the current literature to illuminate some of the effects of various forms of physical activity upon mental health.

Before examining the mental health effects of physical activity, it is necessary to differentiate various forms of activity. There are two basic forms of exercise: aerobic and anaerobic. Aerobic exercise occurs when oxygen is metabolized to produce energy.<sup>6</sup> This occurs during sustained periods of hard work and vigorous activity, generally lasting greater than 3 minutes at a time. On the other hand, anaerobic exercise occurs when the energy required to produce the activity is provided without the use of inhaled oxygen. This type of exercise is limited to short bursts of vigorous activity, uses oxygen stored in the muscles, and therefore typically lasts less than 1 minute.<sup>7</sup> There are also alternative forms of physical activity that are currently gaining in popularity that do not fall neatly into either aforementioned category. These exercises, such as meditation or yoga, involve focused relaxation combined with specific body positions that serve to exercise the body as it relaxes the mind. The effects of aerobic exercise, anaerobic exercise, and alternative forms of physical activity on mental health will all be examined.

#### PROCEDURE

A search was performed using MD Consult in MEDLINE/journals for "2006 to current" using the keywords "mental health + aerobic exercise" and "mental health + anaerobic exercise." These two searches returned a total of 56 different journal articles.

After review for content and applicability to the current paper, 31 of those articles were excluded. Articles were excluded that focused primarily on exercise as an adjunctive treatment for physical disorder or following surgery, as this was outside of the scope of the paper. Although it is interesting to note that many of these studies found that individuals who engage in greater physical activity report higher quality of life even when recovering from significant illness.<sup>8-11</sup> Of the 25 articles reviewed, only 12 directly examined the effects that physical activity or exercise has upon a person's mental health. Relevant information from these 12 articles is reviewed below and the references from these papers were used to obtain additional resources and material.

Additionally, a search was conducted in PsycINFO using the same keyword terms as was used in MD Consult. This search was also limited to 2006 through the present, and was limited to articles written in English, focusing on human participants aged 18 and older. This search produced only 3 results, and 2 of the 3 were deemed relevant. Additional resources were also taken from the references of these 2 articles to fill in gaps for the current review.

### **Aerobic Exercise**

It has been suggested that aerobic exercise has the greatest mood-boosting effects when it is performed continuously for a prolonged period of time.<sup>12</sup> One study determined that the mood elevating results are based on the release of beta-endorphins, which create the feel-good effect, or "runner's high" that occurs following physical activity.<sup>13</sup> Daniel, Martin and Carter examined this in a double-blind within-subjects design using 19 subjects who participated in an aerobics class.<sup>13</sup> Half of the participants ingested naltrexone, an opiate receptor antagonist, prior to the first 75-minute class and the other half ingested a placebo prior to the first class. Individuals who ingested the naltrexone on the first occasion received the placebo prior to the second aerobics class and the group that had received the placebo were given naltrexone for the second class. This study, despite its small number of participants, found significant results within the individuals: participants reported differing effects of exercise when the opiate receptor antagonists was ingested and when it was not. There was a significant mood boosting effect (increase in positive affect) and an anxiety reducing effect (decrease in muscle tension) following the aerobics class in the individuals who received the placebo. Individuals who received the naltrexone did not report any positive shifts in mood or anxiety.<sup>13</sup> This study highlights the important role that endogenous opioids, such as endorphins, play in the normal mood elevating effects of physical activity.

In addition to the endorphin related effects of physical activity, cortisol levels have been found to be altered by exercise. Cortisol, a hormone related to stress, has been found to be moderated and reduced by as little as 30-minutes of moderate aerobic exercise.<sup>14</sup> Higher levels of cortisol are commonly associated with more negative affective states, while reduced cortisol levels have been related to more positive emotional mental states. Rudolph and McAuley<sup>14</sup> conducted a within-subjects experiment in which they compared perceived exertion, salivary cortisol levels and affective responses of 26 runners and non-runners before, during and after a 30-minute run. They found that cortisol levels increased for the first 29-minutes of the run and then decreased following that. Additionally, they found increases in positive affective states following each 30-minute run.<sup>14</sup> While their study suffers from a relatively small sample size and consequently low statistical power, they found evidence to suggest that a decrease in cortisol may partly explain in exercise's mood elevating effects.

Indeed, the mood-elevating effects of various forms of aerobic exercise have been supported for both low and moderate intensity workouts. Twenty minutes of exercise with intensities ranging from light to moderate were equally effective in reducing depression and anxiety, in one study.<sup>15</sup> However, it has not yet been clearly determined how high intensity work-outs affect one's mood or anxiety.<sup>16</sup> In fact, extremely high intensity aerobic workouts have been shown to actually increase anxiety in some situations.<sup>3,17</sup> In response to concerns that most mood-exercise studies had been conducted with convenience samples of relatively fit and active adults, Katula, Blissmer and McAuley<sup>17</sup> used 80 sedentary older adults (average age 67 years) to assess the mood changing effects of exercise on unfit individuals. While they used a within-subjects design in which each participant participated in each exercise condition (low, medium, high intensity workouts), they tested each participant only once, following their one and only completion of each workout intensity. Their results found a decrease in anxiety following the low-intensity workout, no change following the moderate-intensity workout and an increase in anxiety following the high-intensity workout. It seems probable that the participants experienced an increase in anxiety prior to, during, and after the high intensity condition because they were engaged in an extremely physically demanding and tasking undertaking. Despite being "trained" prior to the high-intensity condition, it is likely that the older participants questioned their ability to complete the task, and thus felt uncertainty about their ability to complete the task, and this uncertainty was expressed as anxiety. Their findings that participants also reported a decrease in feelings of self-efficacy in the high-intensity conditions further supports this notion that their anxiety was related to doing a task that they felt uncomfortable with, and not with the exercise in and of itself.<sup>17</sup>

However, other studies have corroborated Katula, Blissmer's and McAuley's<sup>17</sup> findings that high intensity workouts often do not produce a decrease in anxiety. Another explanation is that some high intensity workouts are conducted in the context of highly competitive situations. Thus, the lack of, or delayed onset of, anxiety reduction may be due to the fact that state anxiety was

actually elevated during and immediately following the exercise, and only after the person was removed from the competitive or stressful situation were the body's endogenous mechanisms able to take over and improve mood and/or reduce anxiety. Furthermore, it has been found that the psychological benefits associated with physical activity were maintained for longer periods of time with more moderate forms of aerobic exercise.<sup>3,18,19</sup> This may be because moderate exercise is easier to maintain over long periods of time compared to higher intensity workouts. The risk for physical injury and fatigue are also increased with harder workouts, further supporting the finding that moderate aerobic exercise may be ideal to improve psychological functioning. While differences in calories burned, average heart rate, major muscle groups used, and perceived exertion may differ from one form of aerobic exercise to another (as in swimming versus running, for example), all forms of aerobic exercise have been found to produce similar psychological benefits.

However, it must be noted that studies exist that do not find a statistically significant relationship between aerobic exercise and increase in positive mental health. In a study involving 18 middle aged women who exercised at 70 to 85% of their maximum heart rate three times a week for 30 minutes for 10 weeks, no significant relationship was found between the exercise regime and increases in their perceived self-efficacy or locus of control. However, the authors note that their sample size was small and they were specifically examining if the increase in exercise would produce a change from external locus of control to a more internal locus of control, coupled with increased feelings of self-efficacy.<sup>20</sup> It is unknown if the participants of the study experienced increased positive feelings or reduction in anxiety, as this data was not reported by the authors.

Additionally, low intensity aerobic exercises, such as meditation, yoga, qigong, and tai chi have been found to have positive effects on a person's psychological functioning.<sup>21,22</sup> Qigong is an exercise that encompasses coordinating gentle movements and breathing. Tai chi is a similar exercise that includes the element of mental concentrating with repetitive movements. A study by Frye, Scheinthal, Kemarskaya, and Pruchno found that that qigong combined with tai chi practiced for an hour, three times a week for three continuous months resulted in a decrease in self-reported anxiety.<sup>23</sup> Meditation and qigong, practiced independently, have also been examined and were found to help increase focus and concentration and decrease anxiety and both physical and psychological tension which can negatively impact mental health.<sup>22,24</sup> Additionally, Berger and Owen compared the mental health effects of yoga to the effects of swimming, a more aerobically challenging exercise.<sup>25</sup> They used three groups of students who enrolled in either a lecture class about physical fitness (control group), a yoga class, or a swimming class. They gave participants the State-Trait Anxiety Inventory and the Profile of Mood States on three different occasions throughout the 14-week period of the study. Their results indicated that the students who were enrolled in the yoga class reported similar decreases in anger, confusion, tension, and depression as did the individuals in the swimming class. Berger and Owen's study thus emphasized that there are important mechanisms other than those typically associated with aerobic exercises that produce mood boosting and anxiety reducing effects.<sup>25</sup> While more moderate forms of exercise, such as meditation and yoga, do not incorporate the intensity levels and elevated heart rates typically associated with other forms of aerobic exercise, they result in increased psychological functioning through other mechanisms. Furthermore, Adler and Roberts additionally found significant improvements in physical fitness and mental health through the use of tai chi with older adults.<sup>26</sup> Emphasizing tai chi as slower and more gentle than typical aerobic exercises, it was found to be a suitable alternative to aerobic exercises for individuals who are not capable of more intense workouts.

### **Anaerobic Exercise**

It is generally believed that anaerobic exercise provides the mood boosting effects similar to aerobic exercise only when it is performed at high intensity. As anaerobic exercise is continued at high intensities, there is a build-up of lactate and lactic acid in the muscles; beta-endorphins are associated with the release of this lactate.<sup>12,27</sup> While the specific effects of beta-endorphins and their relationship to various forms of exercise are not well understood, they have been associated with a greater pain threshold following short-term anaerobic exercise. However, increases in beta-endorphins may also be associated with an increase in cortisol and other stress hormone levels, which would not have positive mood effects. Generally speaking, anaerobic exercise requires continued exertion for at least one hour in order to produce positive mental health effects, and it is likely that the intensity of workout required for these effects would exclude the majority of interested participants. In a study done by Caruso and Gill, it was found that there was an increase in feelings of general self-worth and self-esteem following their 10-week anaerobic weight lifting classes.<sup>28</sup> However, each of their 34 participants kept activity logs during the duration of the study and it was found that many of the participants engaged in aerobic activities outside of the study throughout the duration of the study. Therefore, this has the potential to confound the study results and it is unclear whether or not the increases in self-esteem are attributable to the anaerobic exercise or the general increase in overall activity both in and outside of the study. In a follow-up study, Caruso and Gill found that their participants did not have any change or increase in global self-esteem, body image or self-perceptions following completion of a 10-week anaerobic weight lifting program.<sup>28</sup> While their study relied on self-report measures given only at the first and last day of their exercise program, their study provides significant evidence to suggest that anaerobic exercise does not carry with it the mood-elevating effects that aerobic exercise does.

Despite the fact that findings may support the use of anaerobic exercise at high intensities to obtain mood-boosting effects, it must be noted that injuries are also more likely with higher intensity workouts. As with aerobic exercises, the more a person works his or her muscles at high intensities, the more likely it is for the person to develop muscle strains, tears, or other injuries.<sup>12,27</sup> Thus, the high risk for injury associated with the positive emotional effects attributable to anaerobic exercise may outweigh its benefits.

## DISCUSSION

The selection of an exercise plan fitted for each individual is crucial to its success. An activity that may be pleasurable for one person, such as running, may not be the ideal exercise for another person. It is important to choose an activity that reduces tension, fatigue and anger, and this may mean finding one particular activity that best suits a person's fitness/skill level, access to facilities, and schedule. Performed at low to moderate intensities for at least thirty minutes at a time, it was found that there were decreases in anger, confusion, and depression with swimming, biking, or yoga participation.<sup>19, 25</sup> Additionally, if the desired result is an increase in psychological adjustment and a boost to mental health, it is suggested that individuals avoid highly competitive exercises and contact sports that may increase anxiety and anger. While playing football may be something that an individual is very good at and that fits well into his schedule, the stressful and aggressive nature of the sport may not serve to effectively reduce his anxiety or stress levels. Indeed, the positive results found by Berger and Owen may be partially attributable to the fact that their participants voluntarily enrolled in either swimming or yoga as their form of aerobic exercise.<sup>25</sup> Had participants been randomly assigned into one group or the other, it is likely that they may not have found such significant improvements in participants' mental health. Exercise needs to be more than physical activity—it needs to be enjoyable!

## CONCLUSIONS

Physical activity has been demonstrated to improve self-esteem, self-acceptance, self-concept, and self-efficacy, along with reducing amounts of reported depression, anxiety, tension, and stress (including Post-Traumatic Stress Disorder).<sup>30-35</sup> Indeed, a central concept in behavioral activation, an empirically supported treatment for Major Depressive Disorder, is increasing an individual's physical activity.<sup>36, 37</sup> Aerobic exercise has been found to be the best form of physical activity for improving psychological adjustment and well-being as long as it is tailored specifically for each individual. There is little evidence to suggest that one form of aerobic exercise has a greater positive effect than any other type of aerobic exercise, as long as the exercises are performed at similar intensities over the same period of time. As with anything, if a person enjoys the physical activity he is engaged in, he is more likely to continue the activity and garner the positive psychological effects.

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