

The Role of Exercise in Reducing Childhood and Adolescent PTSD, Anxiety, and Depression

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A great many interventions for posttraumatic stress disorder (PTSD) in adults have been described in the literature. These include, but are not limited to, cognitive-behavioral therapy, psychodynamic therapy, psychopharmacology, exposure therapy, anxiety management training, stress management techniques, eye movement desensitization and reprocessing, and physical exercise (Foa & Meadows, 1997). In contrast, there is limited research and empirical support for evaluating treatment interventions for children diagnosed with PTSD. The material below will focus specifically on the role of exercise in reducing not only PTSD but also the major components that are associated with PTSD (i.e., anxiety and depression). Exercise fits in naturally with the ecological framework of children and with their educational curricula.

Effects of Exercise on Anxiety

Following a review of numerous cross-sectional and longitudinal studies, Salmon (2001) found consistent reductions in anxiety in adult samples following exercise. There are a variety of psychologically based explanations as to why exercise reduces anxiety. The distraction hypothesis implies that diversion from unpleasant stimuli or painful somatic complaints leads to improved affect following physical activity (Paluska & Schwenk, 2000). Bandura's (1977) self-efficacy theory suggests that individuals' perceptions of their capability to engage in exercise are increased following actual exercise participation. This might then lead to increases in self confidence and enhancement of mood. The mastery hypothesis proposes that individuals gain a feeling of independence and control and therefore experience less anxiety (Paluska & Schwenk, 2000). Finally, the social interaction hypothesis indicates that those individuals who participate in physical activity gain social support from others, thus improving their mental health (Paluska & Schwenk, 2000).

Physiological explanations of the effect of exercise on anxiety include the monoamine hypothesis, which suggests that exercise enhances brain aminergic synaptic transmission (Paluska & Schwenk, 2000), and that this leads to increased levels of arousal and attention. This neurophysiological enhancement might then result in increased perceptions of self-efficacy and lowered anxiety. The endorphin hypothesis suggests that beta-endorphins are produced throughout the body during exercise and that beta-endorphins decrease pain and create a euphoric state that might be counter to the uncomfortable state associated with anxiety. Lastly, the thermogenic hypothesis proposes that after one engages in physical activity, body temperature rises and this rise is associated with enhancement of mood.

The majority of studies that show anxiety reductions with exercise have been done with adult samples. According to Berk (2007), the few exercise interventions that have been implemented with anxious children and adolescents have resulted in lower levels of anxiety. Berk suggests that the lower levels of anxiety may stem from an increase in the release of endorphins. The improvements in mood that are said to be connected with endorphin release lead to improvements in social skills, increases in self-confidence, and a disregard of negative thoughts.

A lower risk of heart disease, hypertension, type II diabetes, negative mood states, and enhancement of self-esteem are all associated with adult participation in physical activity, according to Parfitt and Eston (2005). However, adolescents and children tend to provide less accurate estimates of their exercise levels than do adults, thereby complicating research efforts. Parfitt and Eston (2005) note that children and adolescents 11-13 years old recalled less than 50% of their daily activities throughout their school day and remembered 55%-65% of their daily activities from the previous day. Thus, the self-report measures that are typically used with adults to assess levels of physical activity would appear to be less desirable when used with children and adolescents. The authors suggest that it is important that objective measures be used to validate the direct relationship between physical activity and anxiety. For example, pedometers, heart rate monitors, and body fat instruments are some of the objective measures that can be employed to assess physical activity. When these measures are Pediatric School Psychology used, Parfitt and Eston (2005) report that anxiety reductions following exercise are then reliably found in children and adolescents just as they are with adult samples.

A study conducted by De Moor, Beem, Stubbe, Boomsma, and De Geus (2006) examined whether clinically significant levels of anxiety might be decreased through exercise. Their sample included adolescent and adult twin samples with diagnosable anxiety disorders as per DSM-IV-TR (American Psychiatric Association, 2000). Results of this study showed that those adolescents and young adults between 14 and 24 years old who exercised regularly reduced their levels of diagnosed anxiety-based disorders, including disorders such as posttraumatic stress disorder, agoraphobia, and specific phobias. Twins not engaging in exercise did not show reductions in DSM-IV-TR based disorders. Findings of Strohle and colleagues (2007) indicate that adolescents not participating in regular exercise have a higher probability of acquiring mental disorders as well as health problems.

Silvestri (2001) suggests that adolescent girls are prone to high levels of anxiety due to various peer pressures. These peer pressures include being part of the “cool” group, performing well in school, wearing fashionable clothes, learning to drive, having a boyfriend, and pleasing their parents. Silvestri maintained that “physical activity is believed to have a cathartic or cleansing effect on the body by providing an outlet for emotions” (Silvestri, 2001, p. 34). The exercise group in Silvestri’s study participated in 50-minute dance classes, four times a week, for 4 weeks. The classes followed a dance routine to elevate the heart rate to 160 beats per minute and ended with a “cool down” to obtain a resting heart rate of 100 beats per minute. The results of this study were that all adolescent females’ anxiety scores decreased whether exposed to physical activity or a combination of both physical activity and relaxation training.

Depression and Exercise

While there is limited research on the relationship between depression reduction and physical activity in children and adolescents (Field, Diego, & Sanders, 2001; Tomson, Pangrazi, Friedman, & Hutchison, 2003), there have been a few studies that suggest physical activity can improve mood and reduce symptoms of depression and anxiety in this population (Penedo & Dahn, 2005).

Correlational studies have examined the relationship between reported levels of physical activity and depression, along with a number of other interpersonal characteristics (Field et al., 2001; Tomson et al., 2003). The samples were divided into lowexercise and high-exercise groups. It was found that the high-exercise group reported significantly less depression than the low-exercise group (Field et al., 2001). Also, results indicated that children who were rated as inactive and those not meeting fitness requirements had an increased risk for depressive symptoms (Tomson et al., 2003).

Studies have also explored the effectiveness of physical activity programs on reducing current levels of depressive symptoms (Annesi, 2004; Crews, Lochbaum, & Landers, 2004). After completing the designated programs, a significant reduction in depression was found among those in the exercise group (cardiovascular and resistance training) and was not found in the nonexercise group (Annesi, 2004). Crews et al. (2004) also found that the aerobic group reported significantly less depression at the end of the program compared to the control, nonaerobic group.

Furthermore, consistent results have been found in cross-cultural experimental studies. A study by Stella et al. (2005) examined the effect of physical activity on depression scores in obese Brazilian adolescent girls. At the end of the 12-week intervention, those who participated in the aerobic exercise group reported significantly reduced levels of depression when compared to the other groups.

While much of the research views physical activity as having a significant impact on depression, there are some who maintain it to be a preventive measure as well. Goodwin (2006) studied the effect of physical activity as a coping strategy. When compared to other strategies often employed by adolescents (e.g., substance use, emotional coping, and aggressive behaviors), physical activity was found to decrease the likelihood of depression.

Some researchers have suggested that gender is a major component in the effectiveness of physical activity in reducing depression; however, some findings conflict. For example, Desha, Ziviani, Nicholson, Martin, and Darnell (2007) found that a lack of participation in structured physical activity was associated with greater risk of depressive symptoms in adolescent males, but not females. In contrast, a study by Brown, Welsh, Labbe, Vitulli, and Kulkarni (1992) implemented a physical activity program with a sample of adolescents from a private psychiatric facility. Posttest depression scores were gathered and the results showed that depression decreased significantly in females, but not males (Brown et al., 1992). The inconsistency of these findings suggests the need for further research.

However, not all research has produced results indicating a positive role of physical activity on depression. A study by Norris, Carroll, and Cochrane (1992) examined the effect of an exercise program on the psychological well-being of a group of adolescents. Participants were assigned to a high intensity aerobic exercise, moderate intensity aerobic exercise, or a nonaerobic flexibility group. Pre and post measures showed no significant reduction in depression scores for any of the groups (Norris et al.).

In an effort to review research on this topic, Larun, Nordheim, Ekeland, Hagen, and Heian (2006) examined 16 studies and found that nine of them found no significant relationship between physical activity and depression. The other five only produced a small effect. It is important to note, however, that many of the studies were critiqued for low methodological quality and contained highly heterogeneous samples. Despite the contradictory findings noted above, the majority of studies in this area show a significant inverse relationship between physical activity and depression (Larun et al., 2006).

One of the most useful aspects of using physical exercise as a way to reduce depression and anxiety is that it fits within the natural ecology of children and adolescents, whereas psychotherapy and psychotropic medication do not. Children and adolescents often have physical education programs within their schools, so exercise can be seen as an integral part of their educational experiences and not as a treatment for psychological problems.

Exercise and PTSD

One of the first studies to specifically evaluate the impact of aerobic exercise on PTSD and the related disorders of anxiety and depression involved a small sample of adults ($n = 9$; Manger & Motta, 2005). These participants had experienced traumatic events such as tragic death of a relative or friend, sexual or physical assault, severe auto accident, combat, severe illness, injury, or disease. Their exercise program consisted of 12 sessions in which there was a 10 minute warm up, 30 minutes of aerobic walking or jogging, and a 10-minute cool down period involving stretching and bicycling. Aerobic exercise was defined as maintaining a rate of 60% to 80% of maximum heart rate. Results of the study indicated that there were significant reductions in PTSD, anxiety, and depression following the aerobic exercise intervention and these reductions were maintained in a 1-month follow-up.

There are no empirically supported and widely held views as to why exercise might result in these benefits, especially reductions in PTSD. As with anxiety and depression, it might be argued that exercise increases endorphin levels, that it provides increased perceptions of mastery, or that it enhances self-esteem through taking positive steps to improve health and appearance, and thus results in a variety of positive emotional and cognitive changes (e.g., Biddle & Fox, 1989; Folkins & Sime, 1981).

From these findings of the relationship between PTSD and exercise in adults, another study was developed to investigate whether PTSD, anxiety, and depression could be reduced in an exercise program involving adolescent females (Newman & Motta, 2007). Fifteen participants, ages 14-17, who met DSM-IV criteria for PTSD were recruited from an all-female residential treatment center. Participants engaged in an aerobic exercise program three times per week for 8 weeks. Due to voluntary dropout and discharge, 11 participants completed all study requirements. Each session began with 5 minutes of stretching and 5 minutes of low-impact warm-up exercise. The next 20 minutes consisted of structured group aerobic exercises (e.g., dance, Tae Bo, walk/jog, etc.) that sustained an elevated heart rate between 60% to 80% of each participant's maximum heart rate. These activities were followed by 10 minutes of cool down involving 5 minutes of low impact exercises and 5 minutes of stretching, using the same format as the preexercise warm up. Participants exercised at least 20 times over the course of 8 weeks. Results of this study showed significant reductions in PTSD, anxiety, and depression.

A similar study was conducted involving 12 female adolescents of the same age range of the Newman and Motta (2007) study above (Diaz & Motta, 2008). Most of the participants were Latina or African American. The physical activity involved speed walking outdoors such that 60% to 90% of maximum heart rate was obtained. This contrasted with the Newman et al. (2007) study mentioned above in which there were a variety of different aerobic exercises used. The program progressed for 5 weeks for a total of 15 exercise sessions. The participants were required to walk 1.5 miles within 23 minutes. Participants engaged in a 1-minute period of slow walking before the exercise intervention as a warm up and also did a 1-minute cool down following exercise. Standardized inventories for PTSD, anxiety, and depression were administered during two baseline points, during intervention, at the end of the intervention, and in a 1-month follow-up period. Over 90% of participants showed significant reductions in PTSD following the exercise intervention. Approximately half of participants showed anxiety reductions and this was less than was expected. Initially low levels of anxiety may have accounted for the lack of even more change. For depression, 25% showed reductions, but again only half of the participants had above-average levels of depression at the start of the study. Overall, the results supported the efficacy of aerobic exercise in reducing PTSD. In the 1 month follow-up, reduction in PTSD was maintained despite the fact that the participants were no longer involved in the aerobic walking. Mixed results were found for anxiety and depression reductions during follow-up.

As indicated earlier, there is no empirically supported and widely accepted mechanism that would explain the psychological benefits of exercise in children and adults; however, the endorphin hypothesis (Steinberg & Sykes, 1985) seems to be an oft-cited explanation for these benefits. The endorphin hypothesis maintains that exercise increases beta-endorphin levels and that these elevations account for improvements. However, it should be noted that many of the studies investigating the endorphin hypotheses have limitations such as selection of representative samples, the use of quasi and preexperimental designs,

lack of control conditions, and other methodological problems (Yeung, 1996). While no widely accepted explanation exists to explain the positive changes that exercise has on PTSD, preliminary results do indicate that these changes are fairly robust. Further research is needed to investigate the beneficial effect of exercise on PTSD in children and adolescents, but the few studies that have been done strongly support the use of exercise in reducing PTSD and related negative affect.

Summary and Implications

Despite the fact that the connection between exercise and reductions in PTSD in children and adolescents is an emerging area where few empirically based studies have been conducted, the initial findings have been encouraging. Similar reductions in childhood anxiety and depression have also been found. Children and adolescents do not seek out therapeutic interventions for problems related to trauma. In fact, many traumatized children are treatment avoidant (Dubner & Motta, 1999). However, exercise programs fit naturally with the children's conceptions of school because virtually all schools have some form of mandated physical fitness training. The inclusion of exercise programs within school-based settings does fit within the ecology of children's views of school and therefore is far less likely to meet with resistance than would standard therapeutic interventions. Thus, exercise programs have the possibility of serving as a meaningful and effective adjunct to formal intervention when issues of PTSD, anxiety, and depression are of concern. Clearly, further work is needed to develop empirically sound methodologies for investigating the role of exercise in dealing with PTSD and other affective disorders. Exercise has long been seen as being of value for the physical well-being of children and adolescents. Empirical findings presented in this paper indicate that exercise has beneficial effects on psychological functioning as well.

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