

Current Evidence and Use of Physical Activity in the Treatment of Mental Illness: A Literature Review

Literaturübersicht zur Sport- und Bewegungstherapie in der Behandlung von psychischen Erkrankungen

Summary

- › **There is currently** considerable literature that discussing the use of physical sporting activity in the treatment of mental illness. The discussion in the literature goes back to as early as 1979, when a trial was conducted by Greist et al. examining the effectiveness of aerobic exercise in patients diagnosed with depression. They found promising initial results and called for more robust studies to replicate the positive findings.
- › **Since then, there have been several studies** published that have looked at different exercise regimes and their utility in different mental illnesses and in special populations. There has also been further research aimed at identifying possible mechanisms for the therapeutic effect of exercise on mental health symptoms. More recently, we have also seen physical exercise being incorporated both locally and internationally into standard practice and guidelines in health institutions for the treatment of mental illness.
- › **This article** will explore the results of a literature review conducted in March 2016. The discussion will be divided into 3 parts: (i) Proposed mechanisms for the therapeutic effect of physical activity, (ii) Current use of physical activity in the treatment mental illness and (iii) Limitations.
- › **It is concluded** that the practice of utilizing physical activity to treat mental illness is growing and has been incorporated into some national guidelines. There is still need for higher quality evidence and optimization of treatment parameters.

KEY WORDS:

Physical Exercise, Mental Health, Illness

Introduction

In 1979, the first randomized control trial was performed that investigated the effect of aerobic exercise on clinically-diagnosed depression (6). 28 patients diagnosed with depression were randomized to an aerobic exercise running program or psychotherapy. A running leader ran in small groups or individually with their patient 3 to 4 times a week for 1 hour. The investigators found that the

Zusammenfassung

- › **Die Anwendung von Sport** oder sportlichen Aktivitäten in der Therapie von psychischen Erkrankungen wird zurzeit in einer Vielzahl von Artikeln diskutiert. Erstmals 1979 wurde die Effektivität von aerobischen Übungen in der Therapie depressiver Patienten von Greist et al. untersucht. Das damalige erfolgsversprechende Ergebnis sollte durch größere Studien repliziert werden.
- › **Seither wurden verschiedene Studien** von unterschiedlichen sportlichen Aktivitäten und Übungen publiziert und deren Anwendung in der begleitenden Therapie von bestimmten psychischen Erkrankungen sowie innerhalb bestimmter Patientengruppen untersucht. Ferner wurde nach den möglichen Wirkmechanismen für den therapeutischen Effekt bei psychischen Erkrankungen und/oder deren Symptomen gesucht. In letzter Zeit sehen wir, dass sportliche therapeutische Aktivitäten in therapeutischen Standards und Richtlinien von psychiatrischen Gesellschaften eingebunden werden, sowohl national (Australien, RANZCP) als auch international.
- › **Dieser Artikel** präsentiert die Ergebnisse einer Literaturrecherche von März 2016. Die Diskussion der Ergebnisse ist in drei Abschnitte untergeteilt. (i) Hypothesen über den Wirkmechanismus dieser therapeutischen Aktivitäten, (ii) gegenwärtiger Stand der therapeutischen Anwendung von Sport und sportlichen Aktivitäten in der Behandlung von psychischen Erkrankungen und (iii) Ausblick und Limitationen.
- › **Die Anwendung** von sportlichen therapeutischen Aktivitäten in der Behandlung von psychisch Erkrankten nimmt zu und hat nun seinen Weg in nationale Richtlinien sowohl in Australien als auch in Deutschland gefunden. Dennoch ist weitere Forschung notwendig, um eine Therapieempfehlung der spezifischen Erkrankung und dem jeweiligen Patienten anzupassen und eine weitere Differenzierung von Sporttherapie zu ermöglichen.

SCHLÜSSELWÖRTER:

Körperliche Aktivität, mentale Gesundheit, Erkrankung

aerobic exercise program was equivalent in its effectiveness in decreasing depressive symptoms as psychotherapy. The authors acknowledged the limitations of their studies and encouraged further studies. There have been a number of studies published that have studied the link between physical activity and mental health. Investigations have been targeted towards specific physical activity >

REVIEW

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interventions and mental health outcomes along with developing scientific models that can explain possible mechanisms for the therapeutic effect.

This article aims to explore the current literature that exists on the association of physical activity and mental health. This literature review will include individual studies, controlled trials, other literature reviews, systematic reviews and meta-analyses that investigate the therapeutic effect of physical activity on mental illness. Following a presentation of the literature will be a discussion that will centre around proposed mechanisms, limitations and current use of treatment. This review is not systematic, but will nonetheless provide clinicians with a useful window into the current state evidence regarding the use of physical activity in the treatment of mental illness.

Methods

Using the search terms “physical exercise” and “mental health” while applying filters for clinical trials, literature reviews, systematic reviews between 2011 and 2016, 574 articles matching the filtered criteria were elicited from Pubmed. 5 years were chosen as convention for recent literature. “Physical exercise” and “mental health” were chosen as search terms to elicit the broadest exploration of the literature that studied the association between mental health and exercise. Articles were chosen based on relevance to the first section of the article. Initial screening was done by looking through titles and abstracts for relevance. Research objectives indicated in the titles and abstracts that did not specify a trial or review evaluating the effect of physical exercise on mental illness were not included. After articles were excluded on the basis of titles and abstracts, the remaining articles were further scrutinized based on a critical appraisal of the paper. The PICO (Population, Intervention, Comparison, Outcome) method was used as a systematic method to determine relevance.

Populations

Populations that did not include patients with a diagnosed mental illnesses were excluded. Mental illness were defined by clinical diagnosis based on the DSM. This excluded populations that exhibited psychological symptoms without a clinical diagnosis. The focus of this review is specifically on the psychological effects of physical exercise. We do not intend to comment on the neurotrophic benefits of exercise that has been extensively researched (14). Thus, we chose to exclude primarily neurological disorders of which the main pathology is neuronal degeneration such as Parkinson’s Disease and Alzheimer’s Disease. This is because, although there may be overlap, there are also mutually-exclusive causal pathways that are responsible for the therapeutic effects on brain degeneration and psychological symptoms. In order to provide greater depth in the discussion, we elected to focus on psychology, rather than neurology.

Intervention

Interventions that did not include physical activity were excluded. Physical activity was defined as any therapy that consisted of physical movements intended to strengthen muscle groups or the cardiovascular system. This includes both aerobic exercises and anaerobic exercises. Ancient Eastern traditions such as Tai chi, Yoga and Qigong were excluded due to their differences in approach and aims compared to Western physical exercise. This is consistent with the exclusion criteria in a Cochrane review published in 2013 by Cooney et al that looked at the effect of exercise on depression (2).

Comparison

The purpose of this review is to communicate evidence that establishes the benefit of physical exercise in mental illness. Thus, the presence of a comparison group was an essential part of the inclusion criteria. Papers that did not contain a comparison group, such as correlational and cross-sectional studies, were excluded. These studies generally represent a lower quality of evidence and are epistemically unable to determine causal relationships. Studies that used the same population as its own comparison were not excluded.

Outcome

Studies that exclusively looked at outcomes focused on physical attributes and fitness were excluded. Outcomes that focused on non-physical symptoms were included. This included psychological and social symptoms. Social factors were included because of their close relation with psychological state.

Organization of Literature Review

Previous literature reviews conducted on the topic of physical activity and mental health stratified research according to mental illness clusters exclusively (23). However, there are other important considerations for mental health professionals to evaluate when thinking about using this intervention for their patients. In addition to clinical diagnosis, the clinical population that the patient belongs to is another essential factor that requires appropriate deliberation. Thus, we have divided populations into both mental illness clusters, as well as three special sub-populations pregnant women, the elderly and adolescents.

There are also important factors related to the intervention itself to be considered. There may be potential therapeutic variance across styles of sport exercise programs (aerobic vs. anaerobic, group vs. individual, etc.) as well as duration (number of hours per week) and intensity (low, moderate, high). Thus, to provide a more holistic understanding of the effectiveness of physical activity, we have divided the literature review into 4 parts: (i) Mental illness clusters, (ii) Special Populations, (iii) Exercise Parameters and (iiii) Adverse Effects of Exercise.

Results

Mental Illness Clusters

Depression

Moura et al. looked at the antidepressant effects of aerobic exercise by performing a literature review of the relevant trials (28). They found approximately 70% of the studies retrieved that show a significant improvement in depressive symptoms. The remaining 30% did not show any significant improvement, however overall physical health was improved (ex. in body fat % and oxygen uptake).

A systematic review conducted by Cooney et al looked at 39 trials with a total of 2,326 participants (2). Trials either had no treatment or a control intervention as the comparison group (psychological therapy, drug therapy or bright light therapy). Overall, a significant difference (SMD=-0.62, CI [-0.81, -0.42]) was found. When stratified according to comparison group, exercise was found to be as effective as both psychological and drug therapy. In the one trial that used bright light therapy as a comparison, physical activity showed a significantly higher therapeutic effect (Mean difference (MD)=-6.40, 95% CI [-10.20, -2.6]).

Table 1

Summary of Research for Mental Illness Clusters. PANSS=Positive and Negative Syndrome Scale; SOFS=Social Occupational Functioning Scale; ISFS=Item Short Form Survey; BBS=Bergs Balance Scale; SMD=Standardized Mean Difference; CI=Confidence Interval; RR=Relative Risk; MD=Mean Difference, * $p<.05$; ** $p<.01$; *** $p<.001$.

AUTHORS	YEAR	INTERVENTION	STUDY TYPE	OUTCOME/MEASURE	RESULT
Depression					
De Souza et al.	2015	Aerobic Exercise	Lit. Review	Depressive Symptoms	70% of studies showed a significant improvement in depressive symptoms.
Cooney et al.	2013	Physical Activity (not specified)	Sys. Review (39 studies)	Depressive symptoms	Significant reduction of depressive symptoms, SMD=-0.62, CI [-0.81, -0.42].
Schizophrenia					
Vera-Garcia et al.	2015	Aerobic exercise & strength training	Sys. Review (13 studies)	PANSS	in PANSS.
Firth et al.	2015	90 min. moderate-vigorous intensity exercise per week	Sys. Review (20 studies)	Psychiatric symptoms (physical & mental health)	Psychiatric symptoms were significantly reduced, SMD=0.72, 95% CI [-1.14, -0.29]. Improved functioning, co-morbid disorders and neurocognition.
Anxiety					
Rebar et al.	2015	Physical activity (varying types)	Meta-meta-analysis (306 studies)	Anxiety	in anxiety, SMD = -0.38, 95% CI [-0.66, -0.11].
ADHD					
Silva et al.	2015	Intense physical activity (relay race; 5 min. run with no breaks)	Experimental	Concentration levels (measured using computer game)	30% improvement in concentration after intense physical activity
PTSD					
Rosenbaum et al.	2015	Physical activity	Sys. Review (4 studies)	PTSD & depressive symptoms	Improvement in PTSD*, 95% CI [-0.63, -0.07], and depressive symptoms*, 95% CI [-0.69, -0.05].

Schizophrenia

A systematic review looked at 20 studies that used 90 minutes of either moderate-high or low-intensity exercise per week (5). When collectively analyzed, there was no significant effect. However, when the trials were stratified by intensity, the researchers found a significant decrease in psychiatric symptoms in the moderate-high intensity trials (SMD=0.72, 95% CI [-1.14, -0.29]). This indicates that there may be therapeutic variance between intensity levels. This issue will be discussed further.

Anxiety

A meta-meta-analysis was performed on 306 studies that investigated the effect of physical activity on anxiety in non-clinical populations (20). The analysis included a total of 10,755 subjects and found a small but significant effect in decreasing anxiety (SMD=-0.38, 95% CI [-0.66, -0.11]).

ADHD

There was one study that specifically looked at ADHD and measured concentration levels on a computer game (27). They compared participants who were exposed to intense physical activity to those who were not exposed before the game. They found a 30.5% improvement in the intervention group compared to the control group.

PTSD

A meta-analysis was performed in a systematic review that focused on physical activity in patients with PTSD (24). The review included 4 RCTs and found a significant improvement in PTSD and depressive symptoms as compared to the control groups. They conclude by recommending physical activity as an adjunctive treatment option for PTSD in addition to usual care.

Population Clusters

Pregnant Women

One quasi-experimental study looked at 109 healthy pregnant women ranging from 22 to 37 years old (8). The subjects in the

intervention group were enrolled in an exercise program and the control group received normal childbirth classes. Using Goldberg's General Health Questionnaire (GHQ-28), the researchers found lower levels of severe depression and lower levels of somatic symptoms in the intervention group compared to the control ($p<.05$).

In the same population above, the authors looked at the effect of single physical exercise classes on mood states of pregnant women (7). A significant improvement of mood ($p<.001$) was observed in all dimensions in the intervention group.

Elderly

A randomized control trial in the Netherlands focused on elderly Turkish immigrants (22). It included 92 immigrants who were >44 years old. The intervention consisted of 8 two-hour sessions of exercise and health education. The control group received 6 educational sessions on available welfare services. The intervention group showed a higher improvement in mental health (0.38 SD, 95% CI [0.03, 0.73]).

Another RCT focused on elderly psychiatric inpatients (12). There were 78 subjects ranging from 50 to 89 years old. They were equally randomized to one of 3 arms: (i) STEP group, which consisted of exercise and psychotherapy, (ii) STALK group, which consisted of only individual psychotherapy and (iii) Control group, which was standard therapy. They found that the STEP group ($M=4.24$, $SE=0.62$) had significantly lower depression scores than either the STALK and control group ($p<.001$).

Adolescents

Rees & Sabia used data from the National Longitudinal Study of Adolescent Health to explore the effect of physical activity on mental health (21). Their initial findings showed an association between exercise and improved psychological wellbeing in teenagers through an ordinary least squares (OLS) estimate. However, after controlling for individual heterogeneity in the data, they found that these associations decreased greatly and became non-significant in a number of analyses. >

Exercise Parameters

One possible confounding effect in the trials that investigate the use of exercise is the variability of exercise parameters. It is possible that effects are influenced by the duration, intensity and style of exercise given to patients.

Aerobic vs. Anaerobic

Scully et al found that a literature review showed no significant difference in the anti-depressive effect of aerobic exercise compared to anaerobic exercise (26). A systematic review that included 14 studies found two trials that compared aerobic and anaerobic exercise (18). They found no significant difference, however they remark that there is a greater volume of evidence to support the use of aerobic exercise rather than anaerobic (18). Another systematic review showed that 3 trials actually combined aerobic and anaerobic training into one exercise regiment, and found a significant reduction in the PANSS score, as mentioned earlier in the mental illness cluster section (33).

Individual vs. Group

A literature review found 5 RCTs showing that both individual and group programs had therapeutic effects (29). However, in both scenarios there was still supervision. Another study found an equal volume of evidence supporting group and individual regiments (18). They also noted that the qualifications of the supervisors varied across studies and so there is currently no evidence to favour professional supervisors (18).

Frequency and Duration

Stanton & Reaburn found that most programs were three times a week with each session around 30 minutes, although there were only two studies that actually mentioned the duration of the session (29). A recent systematic review that examined 20 studies also found 90 minutes per week as an effective dose (5). They found that interventions which failed to show significant differences used shorter durations.

Intensity

They also found that when they included studies that used low-intensity exercise, there was no effect. However, when they focused only on the studies of moderate to high-intensity exercise, they found a significant reduction of psychiatric symptoms (SMD=-0.72, 95% CI [-1.14, -0.29]) (29).

Discussion

Mechanisms

Biological Factors

There have been many articles focused on investigating the biological mechanisms for the outcome effects seen above. Portugal et al. looked at acute exercise mechanisms and described a number of models (14). They found that exercise increases levels of norepinephrine, dopamine and serotonin in animal studies. In another study this association was also found in 18 Japanese male runners, those serum serotonin and betaendorphin increased significantly after the marathon race ($p < 0.05$) (1). This may explain psychological effects in humans, as norepinephrine is associated with alertness, dopamine with the pleasure system and serotonin with anxiety (14). It has also been found that opioids and endocannabinoids are increased during physical activity (14). This may contribute to euphoria and anxiolytic effects. Another important association that has been found is with neurotrophic factors, such as BDNF, GDNF and IGF-1 (14). This is significant as anti-depressants are also

found to increase BDNF levels (31). Chronic effects have been explained by the increases in neurotrophic factors as well as pro-inflammatory responses, which both can promote neurogenesis, angiogenesis and synaptogenesis over time (14). These effects can be both therapeutic and preventative for mental illness.

Another biological model for the therapeutic effects of exercise, known as the transient hypofrontality theory, put forth by Arne Dietrich in 2006 (3). This theory asserts that in an exercise state, the brain redirects its resources and energy to motor structures and away from other areas in the brain, particularly the prefrontal cortex, that are not directly involved in motor functioning (3). Thus, a transient hypoactivity in the prefrontal cortex may provide an explanation for observed effects on mood and cognition.

The author explains that this state has the potential to reverse the neurological pathologies associated with different mental illnesses. For example, PTSD, phobias and other anxiety disorders show hyperactivity in the amygdala and the prefrontal cortex (3). The prefrontal cortex is correlated with attentional and emotional responses (3). It is theorized that hyperactivity of the prefrontal cortex can produce hyper-awareness and vigilance that may lead to increased anxiety (3). Thus, decreasing the activity in the prefrontal region may serve as symptom relief. A similar pattern is noted for depression and obsessive-compulsive disorder (OCD) as well (3). Another neurological correlate to depression specifically is an imbalance in activity between the ventromedial prefrontal cortex (VMPFC) and the dorsolateral prefrontal cortex (DLPFC) (3). The DLPFC is correlated with cognitive functions which are found to show lower activity in depression (3). Physical exercise can correct this imbalance by decreasing overall prefrontal cortex activity.

These studies provide us with biological plausibility, a key factor in establishing causality according to Hill's Criteria (11). However, reducing the complex interaction of physical activity and the mind to simple biological structures is not a sufficient explanatory model. There are psychological effects of activity that also need to be considered.

Psychological Factors

An interesting psychological model for the therapeutic effect of exercise comes from Mihaly Csikszentmihalyi, a positivist psychologist who developed the theory of flow (16). Flow is characterized by a complete absorption and engagement with a particular activity. Physical exercise is a potential and common inducer of this positive psychological state that has been found to have far-reaching effects on the mind. It is characterized by a "focused concentration on what one is doing in the present moment" and "experiencing the activity as intrinsically rewarding, such that often the end goal is just an excuse for the process." These subjective states can be protective and therapeutic with respect to mood disorders.

In order to achieve a flow experience, the activity must perfectly match existing skills (not underutilized or over-matched) and be reasonably challenging. Something that is not challenging will be regarded as boring and something too challenging will be regarded as anxiety-inducing. It is possible that the positive effects seen in patients engaging in physical exercise can be partly attributed to flow experiences.

Just because flow experiences are not limited to physical activity does not mean physical exercise becomes entirely interchangeable with any activity that can induce flow. This is because there are multiple factors that emerge from physical exercise which have therapeutic effects on mental illness. As

discussed in the previous section, there are strong biological effects in addition to the potential for flow discussed here. Other activities, such as art or games that may induce flow will not necessarily have the same effects on the brain.

Another important psychological effect of physical activity is self-efficacy. Physical activity and the feeling of accomplishment that accompanies the end of a session can increase self-efficacy (15). Increased levels of self-efficacy in turn can decrease levels of depression (25). Not only is self-efficacy a consequence of physical activity, but it is also a determinant. Thus, it can become a positive feedback loop.

One other factor that may explain the positive effects of exercise is social interaction. One study found social interaction to be an important mediator in the therapeutic effect of exercise on mood (17). Social interaction as positive interaction with the trainer can be gained in a group exercise setting as well. If the session takes place in public gyms, then social interaction can also come from other gym members.

Current Use of Physical Activity in the Treatment of Mental Illness

Rosenbaum et al. discuss the current use of this treatment across Australia (24). The Mental Health Intensive Care Unit (MHICU) at Prince of Wales hospital in Randwick currently uses a clinical exercise program and has also employed an exercise physiologist. The Mental Health Service in South Eastern Sydney has also employed exercise physiologists in light of growing evidence. The early psychosis program at the Bondi Centre uses exercise regimens in combination with standard care.

We have also seen that The Heart Foundation in New South Wales has published documents supporting the use of physical activity in the treatment of depression (10). Internationally, we have seen the incorporation of physical activity into the UK NICE guidelines for psychosis, schizophrenia, depression in adults and bipolar disorder (19).

In the 2008 Physical Activity Guidelines for Americans, it is stated that there is strong evidence that physical activity reduces symptoms of depression in adults and moderate evidence of a similar effect in children (32). The European Union Physical Activity Guidelines list physical activity as a preventative factor of depression (4).

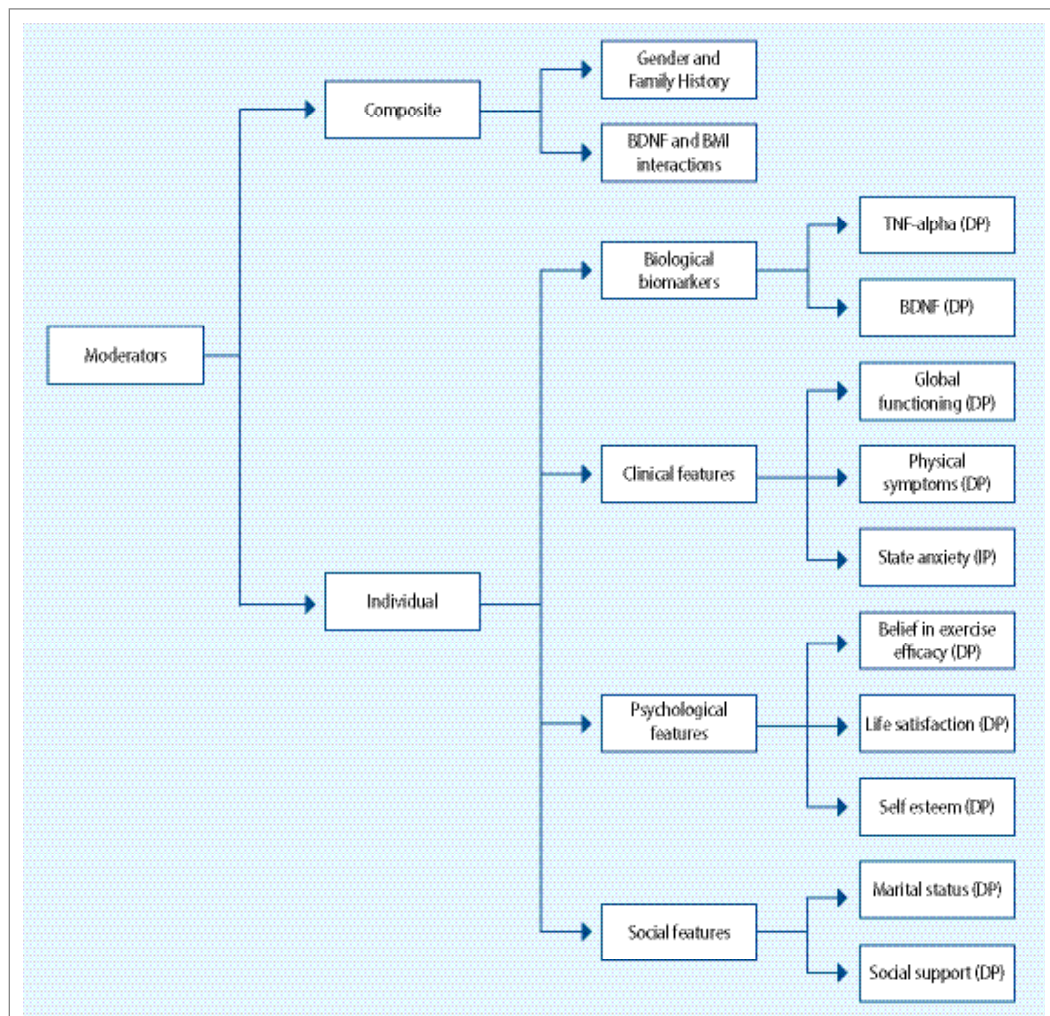


Figure 1

Moderators for anti-depressant effects of exercise in people with major depressive disorder. DP=Directly proportional to effect of treatment; IP=Indirectly proportional to effect of treatment.

Limitations

It is important at this stage to note some of the criticisms in the literature of using exercise as a potential treatment option. Scully et al identified 3 central issues: (i) The evidence shows only moderate effects and for specific exercise regimens for specific illnesses. It should not be interpreted as a treatment for general psychological malaise (ii). Compliance will be a major issue due to the difficult nature of the intervention. (iii) It is possible that people develop exercise addiction, which may lead to worse symptoms if the patient ceases training (26).

Another article provided important considerations for using physical activity in improving outcomes in children (13). It is mentioned that compulsory physical exercises in school can be a source of stress and fright for children, especially if the games are skill-dependent. This is because children are more likely to fail at skill-dependent games, leading to worse mental health and avoidance of physical activity altogether. Thus, the need for physical activity requires proper balance with other important needs of the child.

There are key factors that can moderate the therapeutic effect of physical exercise by enhancing it or decreasing it. A systematic review, which included 11 studies, collectively identified 11 moderating factors for the anti-depressant effects of exercise in patients with major depression (25). Some of these

Table 2

Summary of Research for Population Clusters. SD=Standard Deviation; CI=Confidence Interval, * $p < .05$; ** $p < .01$; *** $p < .001$.

AUTHORS	YEAR	INTERVENTION	STUDY TYPE	OUTCOME/MEASURE	RESULT
Pregnant Women					
Guszkowska et al.	2015	Exercise Program	Quasi-Experimental	Prevalence of severe depression and somatic symptoms	in levels of severe depression and somatic symptoms*
Guszkowska et al.	2013	Exercise Program	Quasi-Experimental	Mood state	Improvement in mood***
Elderly					
Reijneveld et al.	2003	Physical Activity	RCT	Overall mental and physical health	Improvement in mental health and mental wellbeing*, 0.38 SD, 95% CI [0.03, 0.73]. No improvements in physical wellbeing and activity
Jacquart et al.	2014	Physical exercise and psychotherapy (30 min of walking & psychotherapy per session)	RCT	Depressive scores	Depression scores significantly lower in the combo therapy than the other control arms***
Adolescence					
Rees & Sabia	2010	Physical Activity	Secondary Data Analysis	Psychological wellbeing	in frequency of moderate/physical exercise associated with enhanced psychological wellbeing in adolescents. Effect decreases substantially after controlling for heterogeneity

factors were individual, while others were composite (1). The individual moderating effects were TNF, BDNF, global functioning, physical symptoms, state anxiety, belief in exercise efficacy, life satisfaction, self-esteem, marital status and social support. Interaction effects were found with BDNF and BMI, as well as gender and family history. Higher BDNF combined with higher BMI was associated with the greatest response. Women without a family history showed greater remission rates, whereas men showed no such effect. Thus, individual and composite patient factors need to be considered when thinking about prescribing physical exercise. One area that requires more investigation is possible interventions that can help patients with anxiety and depression participate in exercise training and subsequently take benefit from it (30). As described in the systematic review above, state anxiety and self-esteem are both moderating factors in therapeutic effect of physical activity.

Another potential factor that may moderate the therapeutic effect is the flow experience discussed earlier. It is also possible that the moderate effect size and variability in effects can be attributed to lack of physical exercise regimes tailored to induce flow. The consistency of intervention across patients in a study population may be problematic, as many may find the sessions underwhelming or overwhelming. This may lead to negative psychological consequences such as boredom or anxiety that may cancel the positive biological consequences. Understanding this phenomenon is important for future studies as well as for clinicians in choosing the right frequency and intensity of physical exercise.

One study looked at changing the focus and objective the exercise as a possible means of increasing compliance (9). Patients were compared in prescribed exercise for fitness versus prescribed exercise for mood. What this meant was that patients were either told the goal of the exercise regimes was to increase physical fitness or was to improve mood. Generally physical fitness effects are a lot more long term compared to mood effects. Thus, by focusing on mood, immediate accomplishments will increase positive association with the activity and may increase compliance rates. The investigators found partial support for mood-focused exercise over fitness-focused exercise in terms of compliance.

Another limitation with regards to the current evidence is lack of studies focused on comparing various forms and frequencies of exercise between mental illnesses. Perhaps a certain form of exercise has a better effect on a particular mental illness. This may also account for the moderate effect and variability currently seen.

Conclusion

There is a growing body of evidence that supports the use of exercise and sporting activities in the treatment of mental illness. However, the evidence is variable due to heterogeneity of intervention and patient factors as well as poor-quality trials. There is a need for more robust trials, and direct comparisons of exercise parameters to determine the optimal treatment program. Mental health workers should use their clinical judgement when considering exercise interventions for their patients and include issues such as compliance, age, mental health condition and social support in order to choose the appropriate exercise parameters. Knowledge translation is beginning to take place and it is important that future research also aim at qualitatively evaluating these programs by studying perceptions, attitudes and beliefs of patients and mental health workers. ■

Conflict of Interest

The authors have no conflict of interest.

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