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Exercise and Mental Health
Beneficial and Detrimental Effects

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Summary

Physical exercise is increasingly being advocated as a means to maintain and enhance good mental health. In general, findings from research indicate that exercise is associated with improvements in mental health including mood state and self-esteem, although a causal link has not been established. Research on acute exercise indicates that 20 to 40 minutes of aerobic activity results in improvements in state anxiety and mood that persist for several hours. These transitory changes in mood occur in both individuals with normal or elevated levels of anxiety, but appear to be limited to aerobic forms of exercise. In the case of long term exercise programmes, improvements in the mental health of 'normal' individuals are either modest in magnitude or do not occur, whereas the changes for those with elevated anxiety or depression are more pronounced. Evidence from studies involving clinical samples indicates that the psychological benefits associated with exercise are comparable to gains found with standard forms of psychotherapy. Hence, for healthy individuals the principal psychological benefit of exercise may be that of prevention, whereas in those suffering from mild to moderate emotional illness exercise may function as a means of treatment. Exercise may also result in detrimental changes in mental health. Some individuals can become overly dependent on physical activity and exercise to an excessive degree. This abuse of exercise can result in disturbances in mood and worsened physical health. In the case of athletes the intense training, or overtraining, necessary for endurance sports consistently results in increased mood disturbance. Extreme cases of overtraining may

result in the staleness syndrome; a condition associated with deteriorating performance and behavioural disturbances including clinical depression.

Exercise can result in either beneficial or detrimental changes in mental health, and the outcome appears to be largely dependent on the 'dosage' employed. Although recent studies have provided promising findings regarding the efficacy of exercise in clinical samples, additional research is clearly needed. The influence of various programmatic aspects of exercise (i.e., mode, duration, frequency, intensity, setting) on changes in mental health have not been systematically investigated, and the proposed mechanisms by which exercise acts to affect mental health remain largely unsubstantiated.

Mental health problems are pandemic in modern society. A recent study found the 1-month prevalence rate of mental disorders in the United States to be 15.4% (Regier et al. 1988), and stress-related conditions such as anxiety and depression accounted for the greatest proportion of disorders. Furthermore, the effects of stress have been estimated to be a factor in up to 50% of all visits to medical practitioners (Kuyler & Dunner 1976). Psychotropic medication and psychotherapy are effective in treating many mental health problems, but it has been estimated that approximately 20% of affected individuals do not receive any treatment. Psychotropic medications are also associated with a host of adverse side effects and cannot be tolerated by some individuals (Beaumont 1988).

Increasing interest has been paid to the use of alternative means of treating and preventing mental health problems. One nontraditional technique involves the use of long term, or chronic, exercise programmes, and research evidence suggests that exercise is associated with improvements in anxiety and depression (Morgan & Goldston 1987). However, much of the extant research has employed quasiexperimental designs, or suffers from fundamental design weaknesses such as a lack of control and placebo groups (Morgan & O'Connor 1989; Morgan et al. 1990). There remains a clear need to systematically investigate the psychological effects of acute and chronic exercise under controlled conditions in comparison to alternative treatments and placebo conditions.

The purpose of the present article is to attempt to integrate empirical evidence regarding the effects of exercise on mental health. Particular atten-

tion will be paid to the psychological consequences of exercise in clinical samples, and recent research concerning the effects of intense physical training on mood disturbance. Readers interested in information on other aspects of mental health and exercise are directed to earlier reviews (Dishman 1985; Morgan 1985; Morgan & O'Connor 1987; 1989; Raglin & Morgan 1985).

1. Exercise and Mental Health Paradigms

1.1 Psychological States and Traits

The psychological consequences of exercise programmes have been assessed with psychometric measures of states and traits such as depression and anxiety. Traits are relatively stable aspects of personality, and do not change across situations. States, on the other hand, reflect the transient aspects of personality that are mediated by situational factors. Conceptualisations of emotions such as anxiety include both state and trait components (Spielberger et al. 1970), and individuals possessing high levels of trait anxiety tend to display greater increases in state anxiety in threatening and stress-provoking situations. In other words, states can fluctuate as a consequence of a transient manipulation, whereas traits are not responsive to short-term influences. This conceptual distinction has usually led to 2 strategies for studying the psychological effects of exercise.

1.2 Acute Exercise

One approach is to study the effects of an acute, or single, bout of exercise. Because traits are largely unaffected by situational factors, the focus of stud-

ies involving acute exercise has centered on transient changes in psychological states or physiological variables such as blood pressure. In general, acute exercise of a vigorous nature has been found to be associated with reductions in state anxiety and physiological arousal that persist for 2 to 4 hours (Hannum & Kasch 1981; Raglin & Morgan 1987). Although exercise-mediated reductions in anxiety have not been found to be greater than improvements associated with passive interventions such as relaxation (Bahrke & Morgan 1979), some evidence exists suggesting that exercise is qualitatively distinct from passive treatments. Raglin and Morgan (1987) observed that aerobic exercise and quiet rest reduce state anxiety and arousal to the same degree, but the decrement persisted longer following exercise. This effect may be limited to aerobic forms of exercise as initial work (Koltyn et al. 1988) has found that a bout of weight-training exercise does not result in anxiety reduction.

1.3 Chronic Exercise

A second strategy is to study the effects of long term, or chronic exercise programs on psychological traits. Chronic exercise programmes should be of sufficient intensity, duration, and frequency to induce an improvement in fitness. To be adequate, an exercise programme should be held at least 3 times per week and be a minimum of 6 weeks in duration. The psychological changes associated with chronic exercise are less compelling than the effects found with acute exercise. In general, significant psychological improvements have been noted in moderately depressed individuals following participation in chronic exercise, but changes in normal samples are of a smaller magnitude or do not occur (Dishman 1985; Morgan & O'Connor 1989; Raglin & Morgan 1985). That is, exercise does not tend to significantly improve psychological health in individuals who are within the normal range of depression and anxiety at the outset. However, even in the absence of changes in psychological traits, acute exercise can result in transient improvements in psychological states. Furthermore, individuals participating in chronic

exercise programmes typically report 'feeling better' in the absence of significant reductions in depression and anxiety (Morgan 1984). One possible explanation for this finding is that variables other than anxiety and depression (i.e. self-esteem) may be changing (Sonstroem & Morgan 1989).

It should also be noted that even if chronic exercise has a negligible effect on psychological traits in normal individuals, and only transient effects on psychological states, regular exercise may aid in preventing the onset of depression and anxiety disorders. Hence, for many physically active individuals, the primary psychological benefit of exercise is the maintenance of positive mental health, rather than an improvement in mental health. This suggests that the primary psychological benefit of exercise is preventative in nature.

2. Exercise and Depression

An early study that illustrates the contention that exercise does not make normals more normal was performed by Morgan et al. (1970). These investigators studied the effect of participation in 6-week programmes of various forms of exercise in a sample of adult males. It was found that exercise did not result in significant reductions in depression. However, when a subsample of the individuals who were depressed at the outset of the study was assessed, significant reductions in depression were noted.

Greist et al. (1979) compared the effects of a walk/jog programme to 2 forms of psychotherapy in moderately depressed outpatients across a 12-week treatment period and periodically during a 9-month follow-up. At the final follow-up assessment, it was found that the reduction in depression associated with exercise was equivalent to the time-limited psychotherapy and superior to time-unlimited psychotherapy. In a recent replication and extension of this work Greist (1987) assessed the effects of 12-week trials of either exercise, group psychotherapy, or Bensonian relaxation in depressed outpatients. The treatments resulted in similar reductions in depression at the end of the 12-week treatment period. At a 9-month follow-up

the reductions in the exercise and meditation group were found to have persisted, whereas the subjects in the group therapy condition displayed some remission.

The safety and effectiveness of exercise programmes in more severely depressed patients using medication has been questioned, and early reports implied that exercise could act synergistically to result in patients overdosing on their antidepressant medication (Kostrubala 1981). Recent research, however, has demonstrated that depressed patients can exercise without serious complications while maintained on psychotropic medication. Furthermore, long term exercise programmes have been found to result in reduced depression in medicated patients (Martinsen 1987). Hence, exercise has been found to be an effective means of treating moderate depression, and recent evidence suggests it can serve as an adjunct to psychotropic therapy in more severely depressed patients. A review on the benefits of exercise for the specific treatment of depression can be found elsewhere in this issue (Martinsen 1990).

3. Anxiety

The majority of research concerning the influence of exercise on anxiety has been conducted utilising an acute exercise paradigm. Initial work has demonstrated that acute bouts of aerobic activity result in decreases in state anxiety that reach statistical and clinical significance 5 to 15 minutes following the cessation of exercise (Morgan 1979). These reductions generally persist for 2 to 4 hours (Morgan et al. 1980; Raglin & Morgan 1987) before state anxiety returns to pre-exercise levels.

In contrast, relatively few studies have addressed the effects of chronic exercise on trait anxiety, and part of the lack of research may be due to the common notion that exercise may increase anxiety or induce panic attacks in anxiety neurotics. This view originally was expressed by Pitts and McClure (1967) on the basis of their work demonstrating that lactate infusions resulted in elevated anxiety and panic attacks in anxiety neurotics. Although lactate infusions commonly result in

panic attacks in anxiety neurotics, the contention that lactate infusion is analogous to lactate elevations caused by intense exercise has subsequently been found to be flawed (Grosz & Farmer 1969; Morgan & O'Connor, 1989; Raglin & Morgan 1985). A primary problem is that the metabolic consequences of infusion and intense exercise are not directly comparable; lactate infusion results in plasma alkalosis, whereas intense exercise results in acidosis. Furthermore, it has been found that highly anxious individuals typically experience reductions in anxiety following vigorous exercise (Morgan 1979), and it has been reported that in the over 70 000 maximal exercise tests performed at the Cooper Clinic in Dallas, Texas, there were no occurrences of panic attacks (Morgan & O'Connor 1989). However, in spite of evidence to the contrary, the view that exercise can induce panic attacks in anxiety neurotics is still widespread in the field of psychiatry (Barlow 1988).

Recent research has demonstrated that individuals suffering from clinically diagnosed anxiety disorders can benefit from exercise programmes. Martinsen et al. (1989) studied the effects of 8 weeks of either aerobic or nonaerobic exercise on patients suffering from DSM-III-R diagnosed anxiety disorders, including panic disorder with agoraphobia. The drop-out rate averaged 11%, indicating that the subjects were able to tolerate the exercise programmes. Furthermore, both aerobic and nonaerobic exercise were associated with reductions in anxiety of similar magnitude. This initial research indicates that clinically diagnosed anxiety patients can gain psychological benefits from chronic exercise, and it appears the risk of experiencing exercise-induced panic is negligible.

4. Self-Esteem

Participation in long term exercise programmes has also been found to improve self-esteem. However, research in this area has been criticised for being overly simplistic in addressing self-esteem theory and measurement issues (Sonstroem 1984), and a causal link between exercise and self-esteem has not been established. Recent theoretical and

empirical work has derived a more complex model of the interactions of self-esteem and exercise that potentially improve upon earlier approaches. Sonstroem and Morgan (1989) have proposed a model of exercise and self-esteem consisting of physical self-efficacy, physical competence and acceptance, with self-esteem arranged hierarchically from specific to general factors. A number of the postulates implied by the model have been confirmed by pilot research and the model provides a framework for future work in this area.

5. Negative Effects

5.1 Exercise Abuse

In some cases exercise can result in negative psychological changes. For example, Morgan and O'Connor (1989) have described a syndrome they refer to as exercise abuse. Individuals who are exercise abusers typically place an inordinately high priority on physical activity, and are characterised by an unwillingness to quit exercising in the face of medical injury. Exercise abuse may also result in negative social and career consequences. In addition, highly dedicated runners have been found to suffer from eating disorders (Katz 1986), and tend to respond poorly to psychotherapy (Little 1969).

Morgan and O'Connor (1988) have suggested that exercise abuse may be a manifestation of the Opponent Process Theory (Solomon 1980), in which exercise evolves from an activity with a positive hedonic outcome to one associated with negative effects. However, present information on exercise abuse is primarily descriptive, and research is needed to establish its aetiology and prevalence.

5.2 Overtraining and Staleness

Another negative outcome of exercise has been referred to as the staleness syndrome (Morgan et al. 1987; Ryan 1983). Endurance athletes in sports such as long distance running and swimming commonly perform periods of intensified training, or overtraining, in the attempt to enhance perform-

ance. Overtraining schedules may last for a period of several weeks, and are usually followed by large reductions in training, or tapering. It has been found that elevations in training are associated with increases in mood disturbances, and this relationship follows a dose-response pattern. That is, mood disturbance becomes progressively worse as training is increased, and with training tapers mood improves. This dose-response relationship has been observed in swimmers (Morgan 1987a, 1988), speed skaters (Guttman et al. 1984), rowers (Raglin et al. 1990), wrestlers (Morgan et al. 1987a) and may occur in other sports as well.

Tapering schedules typically result in improvements in mood state and physical performance, but some athletes have been found to respond with plateaus or actual decrements in performance. These athletes are considered to be exhibiting the staleness syndrome (Ryan 1983). Stale athletes also commonly suffer from behavioural problems such as sleep disturbances and emotional distress (Morgan 1987). Depression is the primary psychological manifestation of staleness and Morgan et al. (1987a) found that approximately 80% of stale college varsity swimmers studied over a 10-year period exhibit depression of clinical significance.

The only known cure for staleness is rest, and some stale athletes may need to cease training for several weeks. Medical and psychological treatment is often indicated and some research suggests that the effects of staleness may persist for up to 6 months after the initial episode (Barron et al. 1985). Staleness is not an uncommon occurrence in endurance athletes and it has been reported that 64% of elite long distance runners have been stale at some point in their training histories (Morgan et al. 1987b).

The staleness syndrome is most accurately regarded as a psychobiological phenomenon as research has shown that there is close convergence of the physiological and psychological effects of intense training. For example, Morgan et al. (1988) achieved an 89% rate of agreement in categorising stale and healthy swimmers with independent predictions based on either psychological or physiological criteria. Research by O'Connor et al.

(1989) has shown that overtraining in female college swimmers is associated with elevations in salivary cortisol, a hormone linked to depression. Furthermore, cortisol and depression were highest in swimmers identified as stale by their coaches on the basis of performance decrements. Although staleness is largely confined to competitive athletes, some evidence suggests that it can occur in recreational athletes (Yates et al. 1983).

6. Conclusions and Recommendations

Regular exercise can provide a means of primary prevention in psychologically healthy individuals by acting to maintain positive mental health, and recent evidence indicates that exercise provides therapeutic benefits in clinically depressed or anxious patients. However, additional research remains to be performed in this area. Neither the optimal programmatic factors (i.e. mode, intensity, duration, frequency) leading to maximal psychological benefit for both normal and clinical samples nor the systematic assessments of the psychological effects of exercise utilising individuals suffering from various clinical disorders have been established. It would seem reasonable to assume that physical activity would have a greater effect on some disorders compared to others, and an exercise programme could be tailored to maximise psychological benefit. Several explanations for the psychological effects of exercise have been proposed, but the current evidence regarding these hypotheses is inconclusive (Morgan 1985; Morgan & O'Connor 1987; Raglin & Morgan 1985).

Recent evidence has demonstrated that in some circumstances exercise can result in negative psychological outcomes. Intense physical training, or overtraining, can create mood disturbance in individuals free from psychopathology at the outset, and result in clinical depression in the case of the stale athlete. Furthermore, overtraining-induced mood disturbances follow a dose-response pattern in response to the training stimulus, and hormonal changes linked with depression have also been found to follow this pattern. Because of the close linkage between psychological responses and ex-

ercise dosage, the relationship between intense physical training and mood disturbance appears to be causal in nature. On the other hand, the relationship between exercise and positive changes in mental health is less established and its present status is one of association.

Investigation of both the detrimental and beneficial psychological consequences of exercise and mental health could provide insight concerning the interaction of programmatic factors and psychological outcome, as well as the mechanisms responsible for these changes. This information would have practical value in maximising the psychological benefits of exercise programmes in normal or clinical samples. In the case of competitive athletics, such information could provide a method of regulating training to prevent the onset of staleness.

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