The psychological effect of exercise training on patients after a myocardial infarction

A pilot study

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Summary

Most studies of exercise training in patients who have had a heart attack have concentrated on the influence such programmes have on physiological recovery rather than on possible psychological benefits. In order to study the latter, a group of 16 patients participating in the Cardiac Rehabilitation Programme run by the Cape Western Branch of the Heart Foundation of Southern Africa were asked to complete the Cattell Sixteen Personality Factor Questionnaire on entry to the programme and again 6 months later. Eight patients participated regularly in the programme for the full 6 months (the exercising group), while the other 8 (the control group) 'dropped out' within the first few weeks and remained physically inactive for the remainder of the 6 months.

It was found that there were no differences in the personality profiles of the exercising and control groups on admission to the rehabilitation programme. Both groups exhibited considerable psychological impairment — in particular they were emotionally unstable with high levels of apprehension, tension and depression. Six months later the control group showed a further worsening as regards levels of depression and emotional stability, with a small reduction (2%) in tension and a small increase (1%) in imaginativeness. In contrast, the exercising group showed significantly large reductions in depression (10%) and tension (14%) levels, and marked increases in emotional stability (14%) and imaginativeness (12%). We conclude that attendance at the programme played an important role in normalizing their psychological constitutions.

While the physiological adaptations of cardiac patients to exercise training have been fairly exhaustively studied, much less attention has been paid to the role that exercise training might play in their psychological recovery.

As early as 1967, McPherson et al. reported that cardiac patients admitted to an exercise programme were very nervous, highly strung, apprehensive, aloof and even aggressive — personality characteristics that are not uncommon among cardiac patients, who have a distorted self-image and who consider themselves to be semi-invalids. After 24 weeks of exercise training the patients showed favourable psychological changes, in particular they were less tense and had increased self-confidence. These authors concluded that the psychological rehabilitation of cardiac patients was as important as was their physiological recovery.

Since this initial study, other workers have shown that exercise training after heart attack increases morale and confidence for the future and reduces anxiety, depression, hysteria, hypochondriasis and psychasthenia.

As an extension of this work, we used the Cattell Sixteen Personality Factor Questionnaire (16 PFQ) to compare psychological changes in a group of cardiac patients who participated in an exercise rehabilitation programme for 6 months with those in a similar group of patients who were referred to the same programme but who failed to continue exercising either as part of the programme or on their own for more than 4 weeks.

Patients and methods

Patients referred by their physicians or general practitioners to the Cardiac Rehabilitation Programme of the Cape Western Branch of the Heart Foundation of Southern Africa were studied. On admission to the programme the patients underwent a graded, symptom-limited treadmill exercise test with monitoring of their ECG and blood pressure recordings in order to determine the exercise limits which were safe for them.

On the basis of the exercise test results, each was given an individualized exercise prescription comprising 1 hour of exercise (walking, jogging and light calisthenics) at a prescribed heart rate, to be completed 3 times a week. The exercising heart rate was gradually increased over a period of 6–8 weeks, by which time each patient was exercising at up to 90% of his treadmill-measured maximum heart rate. All formal exercise sessions were held at the University of Cape Town Sports Centre on 3 mornings a week, between 06h45 and 08h00. When they had been participating in the programme for more than 3 months, patients were encouraged to exercise for a further 2 hours in their home environment during weekends.

Psychological evaluation

A total of 46 patients were asked to fill out the 16 PFQ before they started the exercise training programme. Of this group, 26 attended the exercise programme regularly for 6 months, and constituted the exercising group. The remaining 20 patients 'dropped out' of the programme at various stages, but none...
stayed in the programme or exercised regularly for more than 4 weeks. This group constituted the control group.

After 6 months follow-up questionnaires were posted to all patients who had completed the initial questionnaires. Eight exercising and 8 control subjects whose ages ranged from 42 to 60 years completed both questionnaires, and data on these were used for analysis.

Data regarding the following personality factors were collected: factor A - reserved v. sociable and outgoing; factor B - low intelligence v. high intelligence; factor C - emotional instability v. emotional stability; factor E - mild and submissive v. dominant aggressive; factor F - serious v. enthusiastic; factor G - expedient v. conscientious; factor H - shy and timid v. adventurous and uninhibited; factor I - tough-minded v. tender-minded; factor L - trusting v. suspicious; factor M - practical and conventional v. imaginative and Bohemian; factor N - naive v. shrewd; factor O - serene v. depressive; factor Q1 - conservative v. experimenting; factor Q2 - group-dependent v. self-sufficient; factor Q3 - uncontrolled v. socially precise; and factor Q4 - composed v. tense.

The initial assessment utilized the Cattell 16 PFQ form A, and the follow-up assessment used the Cattell 16 PFQ form B. The completed questionnaires were coded for statistical analysis.

Statistical analysis

The data from the questionnaires were analysed by means of two multivariate Hotelling's T-squared analyses for independent samples. The evaluation involved two 2-sample cases with different scores on 8 of the primary personality factors of the 16 PFQ each. The following factors were grouped together for the analysis:

**Analysis one** — factors A, C, H, L, M, O, Q3 and Q4 (these factors have been reported by previous researchers to undergo change during exercise training).

**Analysis two** — factors B, E, F, G, I, N, Q1 and Q2 (these factors have not been shown to change with exercise training).

Psychological scores measured on the initial questionnaire were subtracted from scores for the second questionnaire in order to generate the index for relative change of these parameters. Additional multivariate Hotelling’s T-squared analyses for dependent samples were executed to assess pre- to post-training changes for the control and exercising groups separately.

Results

Initially there were no psychological differences between the exercising group and those who ‘dropped out’. Members of both groups were characterized by emotional instability and had high levels of apprehension, tension and depression. Therefore, specific psychological factors could not be used to predict those likely to drop out of the exercise rehabilitation programme.

The results from the multivariate Hotelling’s T-squared analyses for independent samples were as follows: overall difference in scores for analysis one — $T^2 = 530,882; P = 0.01$; overall difference in scores for analysis two — $T^2 = 29,001, P = NS$.

A highly significant $T^2$ value was obtained for analysis one, indicating that the two samples (relative change in parameters in the exercising group v. relative change in the control group) came from different populations. The relative changes recorded overall for the 8 factors were uniformly greater for the exercising group than for the control group. In order to analyse the $T^2$ value and establish which factors contributed to its significance, $t$ tests for testing hypotheses about two independent means were employed.

Since significant differences were expected for the factors in analysis one, it was permissible on theoretical grounds to refer the $t$ values to standard tables of Student’s $t$. Factors C (affected by feelings/emotionally stable), M (practical/imaginative), and O (serene/depressive) exceeded the critical value of $t$ at the 0.01 level of significance, and factors H (timid/venturesome) and Q4 (relaxed/tense) at the 0.05 level of significance. When considered in isolation, results for factors C, H, M, O and Q4 were indicative of the changes in the two groups. The results of the $t$ tests are listed in Table I, and the relative percentage changes in personality factors are depicted in Fig. 1. Consistently larger changes occurred in the exercising group for all these parameters. The results of the additional Hotelling’s T-squared analyses support the trend of the main analysis and show that in the exercising group changes were markedly positive, whereas in the control group they were insignificant.

Discussion

There are two important findings in this study. Firstly, the cardiac patients referred to the exercise rehabilitation programme were characterized by emotional instability and high levels of apprehension, tension and depression. This has frequently been observed in other studies but is not always recognized by medical practitioners and is infrequently cited as a reason for referring cardiac patients to an exercise rehabilitation programme. Higher levels of suspicion (factor L) and self-sufficiency (factor Q2), and lower levels of ego strength (factor H) have also been reported in cardiac patients.

Secondly, this study showed that cardiac patients who exercised under supervision for 6 months showed marked reductions in tension and depression and elevations in emotional stability. The average reduction in tension of 14% (Fig. 1) for the exercising

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exercise. These authors measured decreased anxiety and depression levels in patients participating in exercise rehabilitation programmes after myocardial infarction. Similar changes were reported by Ismail and Trachtman in a study on previously sedentary faculty staff.

Although the beneficial psychological changes induced by the rehabilitation programme seem to be wholly attributable to the physical exercise component, other possible factors must also be considered. In particular, patients attending the programme have regular contact not only with doctors but also with a large number of patients who have been through a similar ordeal. One or both of these factors might play an important role in the psychological rehabilitation of these patients. Furthermore, it should be remembered that since the training programme is voluntary, the question must be posed whether only patients with a certain type of personality with certain prerequisites for possible change are willing to volunteer for participation. Similarly, it is possible that patients who 'drop out' from the programme lack the capacity for psychological change. This possibility would have been excluded by a randomized trial, which was not possible because of the referral nature of our programme.

It should also be noted that on initial evaluation all patients showed very high levels of anxiety. This naturally allows more room for improvement than would be possible in less anxious persons. Indeed, McPherson et al. have found that cardiac patients experience greater and more beneficial personality changes with exercise training than do healthy individuals.

However, when considered in combination with enhanced physical fitness, the psychological changes measured in the exercising group indicate the progress they have made towards a more complete physical and psychological recovery after myocardial infarction. Together these factors suggest that any rehabilitation programme for cardiac patients must include a supervised exercise component as an important priority.

This work was funded by the Cape Western Branch of the Heart Foundation of Southern Africa. John Penberthy and his staff at the University Sports Administration are thanked for their assistance in allowing the free use of the University of Cape Town Sports Centre. Sister Thérése de Boer is thanked for her unstinting service in this Rehabilitation Programme and for her assistance with this project.

REFERENCES