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RESEARCH ARTICLE

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EFFECT OF EXERCISE-BASED CARDIAC REHABILITATION PROGRAM ON MENTAL HEALTH AT PATIENTS AFTER MYOCARDIAL INFARCTION

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ABSTRACT

Objective: The aim of the present review is to evaluate the effect of an exercise-based CR program on mental health at patients after myocardial infarction. **Materials and Methods:** PubMed/Medline and Scopus/Elsevier electronic databases were searched for English control trials with no publication date limitation. **Results:** The articles that finally met all the inclusion criteria and were analyzed, after the screening of the title, the summary and the whole text, were 3. A total of 488 patients who received exercise-based CR were examined in this review. **Discussion:** The review demonstrated that exercise in the CR improves the psychological parameters of patients after an acute coronary episode. Systematic exercise of various types and moderate intensity, in supervised CR programs of 2-3 months, reduced the levels of adverse characteristics at all ages and in both sexes, while in fact no individualized psychological help was given to any patient during the intervention. Among those who have experienced OEM for the first time, there are increased levels of fear - avoidance of exercise that can lead to restriction of movement and activity, thus worsening their condition and making it difficult for them to recover. Participating in a 4-month exercise program significantly reduced the levels of these beliefs, while increasing the physical activity levels of these patients.

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INTRODUCTION

Coronary heart disease and negative psychological characteristics have a two-way relationship. Numerous studies have shown that patients with an acute myocardial infarction experience intense emotional states at high rates (depression 16 - 51% 285, 286 anxiety 20 -50%) (1,2) which are of particular importance if compared to their counterparts. in the general population (depression: 5 - 10% (3,4) 289, 290, anxiety: 3.1 - 8.1%).(5) These conditions have shown to be very often not temporary, since in a large percentage (> 25%) are recurrent (6), remain chronic if not treated (1, 7-8) and through various pathophysiological mechanisms (9) are associated with serious complications after myocardial infarction, such as increased mortality, (10-11) at least mild exacerbation of physical symptoms, reduced ability to exercise, worse quality of life. (3) Additionally, the psychological comorbidities affect the results of each therapeutic intervention long-term, as they are related to the patient's low compliance with the medication, a healthy lifestyle, and participation in programs. (12,13). Several studies show that patients with coronary heart disease at a relatively young age have an unfavorable long-term prognosis. (14-15). However, there are not enough studies with a sample of young age, as they constitute the smallest percentage of coronary heart disease patients.

Depression and anxiety in cardiac patients are underdiagnosed by doctors and nurses and often not treated. A urgent need for use of psychometric 'tools', before the patient is discharged from the hospital, 2-3 months later and periodically if necessary is presented (3, 16-17). The exercise-based cardiac rehabilitation (CR) program aims to extend the lifetime of patients, but also to improve its quality, whose psychological parameters are a key dimension. Information about the patient's psychological condition is necessary for his evaluation and should be considered during the physiotherapy intervention. The aim of the present review is to evaluate the effect of an exercise-based CR program on psychological health at patients after myocardial infarction.

MATERIALS AND METHODS

Data Design, Sources and Search Strategy: A search strategy was developed based on the intersection of 2 search themes: cardiac rehabilitation program and exercise safety. The following databases were searched: Medline databases (via PubMed), and Scopus /Elsevier. Additional relevant research was also identified by direct search in scientific journals available online. The results are presented as per the Preferred Reporting Items for Systematic Reviews and

Meta-Analysis (PRISMA) reporting guideline (supporting checklist/diagram). (18) Three unique studies were included in the review.

Inclusion Criteria: The review included studies designed to evaluate the effect of an exercise-based CR program on psychological health at patients after myocardial infarction. No limitation about the publication date. Case reports and case series were excluded.

Study selection: Eligibility screening of the studies was conducted in a blinded standardized way by two independent reviewers (E.T. and G.X.). Titles and abstracts were screened using and duplicate articles were excluded. After screening titles and abstracts, full paper copies were retrieved. Full text screening was also performed blinded by the same reviewers (E.T. and G.X.). Disagreements between authors during any stage of the screening process were resolved by consulting a third reviewer (E.T.).

RESULTS

The articles that finally met all the inclusion criteria and were analyzed, after the screening of the title, the summary, and the whole text, were 3 (Table 1). Lavie & Milani (19) conducted a cohort study published in May 2006. The study aimed to determine the initial psychological characteristics as well as the general risk profile in young coronary patients and to compare them with those of older patients after a coronary episode. They also investigated the effects of Phase 2 CR with exercise in this group of young coronary patients. They studied patients after heart attacks (OEM, unstable angina, coronary angiography) who came to a New Orleans clinic and participated in a CR program. The evaluation consisted of detailed information on 104 young patients with a mean age of 48 ± 6 years (73.1% men) compared with 260 elderly patients with a mean age of 75 ± 3 years (75.4% men) collected before and after completion. Exercise-based 2nd Phase CR (2-6 weeks after the heart attack and 1 week after the end of the 2nd Phase). All patients completed weighted questionnaires at the beginning and end of the program to assess behavioral characteristics (The Kellner Symptom Questionnaire) as well as quality of life (The Medical Outcomes Study 36 - Item Short-Form Health Survey). The exercise protocol generally consisted of 12 weeks of 36 teaching and training sessions, where the training sessions included 10 minutes of warm-up, art gymnastics and stretching, followed by 30 to 45 minutes of continuous aerobic and dynamic exercise as well as light isometric exercise and about 5 up to 10' recoveries. Exercise intensity was predicted near the anaerobic or respiratory threshold, set by the initial value of a cardiorespiratory fatigue test, and 10 to 15 beats/minute below the level at which each exercise can cause silent myocardial ischemia. The patients were encouraged to perform 1-3 exercise sessions per week at home, and periodically adjusted the exercise regimen for a gradual improvement in overall exercise performance.

Along with the exercise, all patients were given workshops and group sessions on all aspects of the disease and counseling on risk factors, but no individual help was provided for psychological factors or high-risk patients with high levels of negative behaviors. Compared to older patients, younger patients initially had a higher body mass index (12.2%, $P < 0.001$), a higher proportion of cholesterol (total cholesterol / high-density lipoprotein) (14.6%, $P < 0.01$), highest level of triglycerides (27.2%, $P < 0.01$), and lowest level of high-density lipoprotein (HDL) (-8.8%, $P = 0.045$). Young patients also had higher scores on anxiety and hostility (51.5% and 94.4%, respectively $P < 0.001$ for both), significantly higher prevalence of anxiety symptoms (27.9% vs. 13.5% $P < 0.01$) and hostility (12.5% vs. 4.6% $P < 0.01$), and slightly more depressive symptoms (23.1% vs. 18.8%), compared with elderly patients. At the end of the program, all patients showed improvement in most of the parameters examined with differences that in some of them were not statistically significant. The young patients showed an improvement in body mass index (-1.7%, $P < 0.01$), body fat percentage (-4.4%, $P < 0.001$), high-density lipoprotein (HDL) levels (10, 2%, $P < 0.001$), at high sensitivity levels

of C-reactive protein (-33.3%, $P < 0.01$), maximal oxygen consumption (11.3%, $P < 0.001$), resting heart rate (-4.5 %, $P = 0.01$), and resting systolic pressure (-2.3%, $P = 0.049$). Significant improvements were also seen in the scores regarding depression (-58.5%), anxiety (-46.0%), hostility (-45.7%), psychosomatic disorder (-33.8) %, and quality of life (15.8%) ($P < 0.001$ for all these parameters). In November 2013, a study was published by Åhlund *et al.* (20), which aimed to examine the beliefs of fear-avoidance exercise in patients who had first experienced OEM and to determine the way these beliefs change over time. A further goal was to analyze fear-avoidance beliefs and physical activity levels in patients participating in an exercise-based CR program under the supervision of a registered physiotherapist, compared to a control group. Therefore, a prospective study was designed involving 62 patients who had experienced OEM for the first time with a mean age of 61 years (42-73 years).

During the visit/review 1-2 weeks after the heart attack, patients received - as is usually the case (in Sweden) - brief information and advice from a physiotherapist to participate in an exercise program. Thirty-four patients chose exercise-based cardiac rehabilitation as the exercise group, while 28 patients chose the control group of their choice not to participate in the exercise program. All patients 1 month after the heart attack completed 2 questionnaires (m - FABQ) and 1 more questionnaire to collect useful information about their history. The questionnaires were completed again during the re-examination 4 months after the heart attack by the patients of both groups. (57 out of 62 answered) The patients of the experimental group, after taking part in a sub-maximum fatigue test on a cycloergometer and were advised from the physiotherapist, took part in a program of aerobic exercises and muscle endurance exercises according to international guidelines. Clinically related fear-avoidance beliefs occurred in 48% of patients during the first trial, while during the retest, beliefs appeared in only 21% of patients. Respectively, the initial values during the first test were 69% for the exercise group and 29% for the control group, while during the re-test there was no longer any significant difference between the two groups. The total amount of physical activity and the intensity of the exercise, gradually increased for the exercise group, which is very important, compared to the control group. In November 2016, Korzeniowska-Kubacka *et al.* (21) published a study to evaluate the effectiveness of an exercise-based program, without the intervention of a psychologist, on depression, anxiety, exercise, and the balance between sympathetic and pneumogastric, in patients after myocardial infarction and compare the differences between men and women. Thirty-two men aged 56.3 ± 7.6 years and 30 women aged 59.2 ± 8.1 years, after a myocardial infarction, took part in an exercise program, lasting 8 weeks, 24 break workouts, a stationary bike with an ergometer, three times a week that started on average 3 months after the acute episode. Prior to and after exercise, patients underwent a Beck Depression Inventory, a State-Trait Anxiety Inventory, and a symptom-limited exercise test during which analyzed the maximum project load, and the double product (double product - RPP). The male participants did not experience anxiety or depression from the beginning of the study and this condition did not altered through the study. The female had more intense initial depression and anxiety in the A-state (current state) which decreased significantly after the exercise program (14.8 ± 8.7 compared to 10.5 ± 8.8 ; $P < 0.01$) and (45.7 ± 9.7 compared to 40.8 ± 0.3 ; $P < 0.01$) respectively. Exercise capacity increased in both groups with an observed increase in exercise duration of 22.8% in men and 26.2% in women and an increase in workload of 29% in men and 22.4% in women. The double rest product decreased in both groups, while the double product increased during exercise in men by 26.4% and less in women (8%). In addition, the exercise program favorably modified the parameters of action of the parasympathetic nervous system.

DISCUSSION

A total of 488 patients who received exercise-based CR were examined in this review.

Table 1. Studies included in the review

Author (year)	Method	Sample (n)		(Follow up)	Intervention Type	Conclusion
		Size	Age			
Lavie & Milan, 2006	Prospective cohort study	364 Group of young people: 104 Club of elderly: 260	48 ± 6 75 ± 3	13 weeks	CR& exercise (Without personalized psychological help) II Phase / 2-6 weeks. After OEM12 weeks, 36 plus, 10 preheating 30 – 45' continuous aerobic & dynamic, & light isometric 5 - 10' rehabilitation intensity near the anaerobic or respiratory threshold Extra 1-3 sessions / week at home	Young patients with coronary disease are characterized by a higher degree of psychological distress (anxiety, aggression, depression, psychosomatic disorder). The above adverse characteristics are significantly improved after the completion of exercise programs
Ahlund <i>et al.</i> , 2013	Prospective cohort study	Total: 62 Exercise group: 34 Control group: 28	M.O: 61 (42 - 73)	4 months	Exercise (1 month after OEM) aerobics & muscle endurance exercises	Reduce levels of fear-exercise-belief beliefs. Increase levels of physical activity and exercise
Korzeniowska-Kubacka <i>et al.</i> , 2016	Clinical trial	Total: 62 Male group:32 Female group: 30	56.3 ± 7.6 59.2 ± 8.1	8 weeks	Exercise only 3 months after OEM 8 week 3 times/ week. 24 static bike training sessions with ergometer	Reducing the occurrence of anxiety and depression in women after myocardial infarction

Three important findings were presented from the research of Lavie & Milani. (19) First, young patients make up a significant portion of the coronary heart disease population participating in exercise-based CR programs. Second, young patients with heart attacks are characterized by a higher degree of psychological distress (anxiety, aggression, depression, psychosomatic disorder), obesity and dyslipidemia. Third, the above adverse characteristics have improved significantly after the completion of Phase 2 of exercise-based CR program. For this reason, such programs play an important role, despite the various obstacles faced by younger patients, such as return to work and family obligations, to be referred for CR and be given strong encouragement to participate and to complete these programs. The researchers even reported that in 249 coronary heart disease patients, mainly young people who did not participate in a CR program and had participated as the control group in another study they conducted, no significant improvement in behavioral factors was observed over time. The above-mentioned reduction in patients' negative emotions in the present study is not due to luck or a 'natural' return to the pre-heart attack psychological state, but rather to exercise-based CR intervention. The current evidence shows that compared to male, a higher percentage of female after OEM (and even younger ones) who show symptoms of depression (22-23) and anxiety (24-25). At Åhlund *et al.*'s (20) research compared with the control group, the exercise group that participated in a CR program, based on physical exercise, under the supervision of a registered physiotherapist, showed increased levels of fear-avoidance beliefs during the first test. Which decreased significantly over time. Patients in the exercise group significantly increased levels of physical activity and exercise over time. For this reason, an exercise-based CR program is unreservedly recommended for patients with myocardial infarction, especially those with elevated levels of fear of movement. According to Korzeniowska-Kubacka *et al.* (21) participation in a physical exercise program contributes beneficially to the reduction of anxiety and depression in female after myocardial infarction. The manifestation of anxiety or depression did not change in male (since, as mentioned above, no manifestation of anxiety or depression was found in male at the initial assessment). The effect of an exercise-based CR program on exercise capacity and sympathetic-parasympathetic balance was beneficial in both women and men after myocardial infarction. It is common for patients and their families to believe that physical activity and post-OEM exercise may put the patient at risk of sudden death. This results in reduced activity, which hardens the recovery process, perpetuates depression, and increases the risk of developing other health problems (26). Patients experiencing fear of movement have lower rates of CR and poor quality of life. (27) It is even reported that exercise avoidance stress is an important prognostic indicator for the occurrence of major heart attacks in myocardial infarction, regardless of the severity of the disease and their depressive symptoms (28). It should be noted that various systematic studies (29-31) show that the effect of exercise on improving psychological parameters is positive, but report methodological problems in the design of the studies (small sample, lack of randomization, follow-up period. etc.).

Further methodologically research is needed to document the benefits. Patients with high levels of depression according to the instructions of cardiologists are advised to administer medication (SSRIs) (32-34) but with great caution as some drugs have adverse effects on heart function (35-36) However, there are patients for whom Antidepressants are not the treatment of choice because of concomitant problems (37) while others are reluctant to take them or do not respond to treatment. (38) The benefits for heart attack psychotherapists when applied alone do not have sufficiently documented. A study (ENRICH) of 2481 heart attack patients showed that psychosocial interventions significantly reduced depression and social isolation from antidepressant medication (serotonin), but did not differ in their effects on mortality and morbidity. (39) In contrast, Blumenthal *et al.*, (2004) (40) examining in the same sample (of the ENRICH study) the importance of patients' participation in regular exercise, 6 months after OEM, found in a follow-up period of 4 years, that in These high-risk patients due to depression and social isolation accounted for half the deaths and far fewer non-fatal new heart attacks than non-practitioners. There is also research showing that exercise combined with psychosocial interventions is more effective in reducing depression than standard care alone (41-42). Although depression and fear are in themselves an obstacle to participating in a exercise-based CR program, cardiologists as well as the staff of CR centers can and should encourage patients to do so. The exercise, if not as an alternative but as a complementary method, can benefit thousands of patients experiencing the psychological effects of the disease. Regarding physiotherapy intervention, it is worth noting that according to the guidelines of the International Organization for Physical Therapy in Mental Health (IOPTMH), recognized as a subgroup of the World Confederation of Physiotherapy in 2011 by W.C. our country since March 2016 Scientific Department: "Physiotherapy in Mental Health" of N.P.D.D. "Panhellenic Association of Physiotherapists" not only the role of the physiotherapist is important in the treatment of mental disorders, but it is an integral part of the interdisciplinary approach team (43).

CONCLUSION

The present review has demonstrated that exercise in the CR helps to improve the psychological parameters of patients after an acute coronary episode. Evaluation using different, valid and reliable tools (Beck depression inventory, state-trait anxiety inventory, the Kellner Symptom Questionnaire) showed that the psychological effects of myocardial infarction are higher in women and younger patients. Systematic exercise of various types (intermittent, continuous) and moderate intensity, in supervised CR programs of 2-3 months, reduced the levels of adverse characteristics (depression, anxiety, aggression, psychosomatic disorder) at all ages and in both sexes, while in fact no individualized psychological help was given to any patient during the intervention. In addition, among those who have experienced OEM for the first time, there are increased levels of fear - avoidance of exercise that can lead to restriction of movement and

activity, thus worsening their condition and making it difficult for them to recover. Participating in a 4-month exercise program significantly reduced the levels of these beliefs, while increasing the physical activity levels of these patients.

Conflict of Interest: The authors declare no conflict of interest.

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