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COMPONENTES CENTRAIS DOS PROGRAMAS DE REABILITAÇÃO CARDÍACA NA PESSOA SUBMETIDA A CIRURGIA CARDÍACA: UMA SCOPING REVIEW

CORE COMPONENTS OF CARDIAC REHABILITATION FOR PEOPLE UNDERGOING CARDIAC SURGERY: SCOPING REVIEW

COMPONENTES BÁSICOS DE LOS PROGRAMAS DE REHABILITACIÓN CARDIACA PARA PERSONAS SOMETIDAS A CIRUGÍA CARDIACA: UNA REVISIÓN DE ALCANCE

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RESUMO

Introdução: Atualmente, o número de cirurgias cardíacas tem aumentado, sendo uma opção de fim de linha quando o tratamento médico não consegue dar resposta aos problemas dos indivíduos, objetivando a reparação da disfunção do funcionamento mecânico do coração. A reabilitação cardíaca (RC) corresponde a uma intervenção multidimensional, que contempla a educação e a modificação dos fatores de risco cardiovasculares, no sentido de melhorar a qualidade de vida dos indivíduos. O exercício físico sendo um componente central dos programas de RC constitui uma estratégia que promove a melhoria da performance física, assim como a redução da sintomatologia associada à doença e cirurgia. Por estes motivos, face às implicações resultantes dos processos patológico e cirúrgico no doente submetido a cirúrgica cardíaca é necessário definir, implementar e avaliar intervenções que possibilitem minimizar o impacte funcional nos indivíduos afetos a estas condições.

Objetivos: Mapear e analisar os programas de RC fase II, que incluam indivíduos submetidos a cirurgia cardíaca clássica, com foco nas componentes do exercício físico.

Metodologia: Scoping Review (ScR) com base nos princípios preconizados pelo Joanna Briggs Institute®. Dois revisores independentes realizaram a análise de relevância dos artigos, a extração e síntese dos dados. Foram definidos como critérios de elegibilidade estudos de qualquer nível de evidência, que descrevam claramente a intervenção realizada na fase II da RC e que na sua população alvo incluam indivíduos submetidos a cirurgia de revascularização do miocárdio e cirurgia valvular cardíaca. Foi efetuada pesquisa sem limite temporal nas fontes de dados EBSCOHost, Web of Science, Scopus e literatura cinzenta.

Resultados: Foram incluídas 28 publicações nesta revisão. A intervenção varia entre as 3 semanas e os 12 meses, com sessões de treino diárias a 2-5 vezes por semana, com duração de 30 a 60 minutos. A intensidade e o tipo de exercício prescrito foram áreas com uma grande dispersão, sendo que a maioria dos estudos privilegiam o treino anaeróbio, de baixa a moderada intensidade.

Discussão: A avaliação dos programas é realizada, maioritariamente, no início, a meio e no fim dos mesmos, recorrendo a escalas como forma de medir a qualidade de vida, capacidade cardiorrespiratória e funcionalidade. As características da intervenção, duração e os instrumentos de avaliação divergem entre os estudos.

Conclusão: Mais investigação deve ser realizada, de forma a que se consiga aferir qual a amplitude dos critérios frequência, intensidade, tipo e duração do exercício físico a implementar na pessoa submetida a cirurgia cardíaca, na fase II da RC. O mapeamento das intervenções que passíveis de serem utilizadas nos programas de RC fase II poderão ajudar a aferir quais os principais componentes a considerar nos programas de intervenção, para uma tomada de decisão em Enfermagem de Reabilitação fundamentada, bem como identificar áreas prioritárias de investigação.

Descritores: Cirurgia Cardíaca, Reabilitação, Qualidade de Vida, Exercício Físico

ABSTRACT

Introduction: Currently, the number of heart surgeries has increased, being an end-of-line option when medical treatment fails to respond to individuals' problems, aiming to repair the dysfunction of the heart's mechanical functioning. Cardiac rehabilitation (CR) is a multidimensional intervention that includes education and the modification of cardiovascular risk factors in order to improve individuals' quality of life. As a central component of CR programs, physical exercise is a strategy that promotes improved physical performance, as well as reduced symptoms associated with the disease and surgery. For these reasons, given the implications resulting from the pathological and surgical processes in patients undergoing cardiac surgery, it is necessary to define, implement and evaluate interventions that make it possible to minimize the functional impact on individuals affected by these conditions.

Purpose: To map and analyze phase II CR programs that include individuals undergoing classic cardiac surgery, with a focus on physical exercise components.

Methodology: Scoping Review (ScR) based on the principles advocated by the Joanna Briggs Institute®. Two independent reviewers analyzed the relevance of the articles and extracted and synthesized the data. Eligibility criteria were defined as studies of any level of evidence, which clearly described the intervention performed in phase II of CR and whose target population included individuals undergoing coronary artery bypass grafting and heart valve surgery. An unlimited search was carried out in the EBSCOHost, Web of Science, Scopus and gray literature data sources.

Results: 28 publications were included in this review. The intervention varies between 3 weeks and 12 months, with daily training sessions 2-5 times a week, lasting between 30 and 60 minutes. The intensity and type of exercise prescribed were areas with a wide dispersion, with the majority of studies favoring anaerobic training, of low to moderate intensity.

Discussion: Most programs are evaluated at the beginning, middle and end of the program, using scales to measure quality of life, cardiorespiratory capacity and functionality. The characteristics of

the intervention, its duration and the evaluation instruments differ between the studies.

Conclusion: Further research should be carried out in order to ascertain the range of criteria for the frequency, intensity, type and duration of physical exercise to be implemented in people undergoing cardiac surgery in phase II of CR. Mapping the interventions that could be used in phase II CR programs could help to determine the main components to be considered in intervention programs, for informed rehabilitation nursing decision-making, as well as identifying priority areas for research.

Descriptors: Cardiac surgery, Rehabilitation, Quality of life, Exercise therapy

RESUMEN

Introducción: En la actualidad, el número de cirugías cardíacas ha aumentado, siendo una opción de final de línea cuando el tratamiento médico no logra responder a los problemas de los individuos, con el objetivo de reparar la disfunción del funcionamiento mecánico del corazón. La rehabilitación cardiaca (RC) es una intervención multidimensional que incluye la educación y la modificación de los factores de riesgo cardiovascular con el fin de mejorar la calidad de vida de las personas. Como componente central de los programas de RC, el ejercicio físico es una estrategia que promueve la mejora del rendimiento físico, así como la reducción de los síntomas asociados a la enfermedad y a la cirugía. Por estas razones, dadas las implicaciones derivadas de los procesos patológicos y quirúrgicos en los pacientes sometidos a cirugía cardíaca, es necesario definir, implementar y evaluar intervenciones que permitan minimizar el impacto funcional en los individuos afectados por estas condiciones.

Propósito: Mapear y analizar programas de RC en fase II que incluyan individuos sometidos a cirugía cardíaca clásica, con especial atención a los componentes de ejercicio físico.

Metodología: Scoping Review (ScR) basada en los principios defendidos por el Joanna Briggs Institute®. Dos revisores independientes analizaron la pertinencia de los artículos y extrajeron y sintetizaron los datos. Los criterios de elegibilidad se definieron como estudios de cualquier nivel de evidencia, que describían claramente la intervención realizada en la fase II de la RC y cuya población diana incluía individuos sometidos a bypass aortocoronario y cirugía valvular cardiaca. Se realizó una búsqueda ilimitada en las fuentes de datos EBSCOHost, Web of Science, Scopus y literatura gris.

Resultados: Se incluyeron 28 publicaciones en esta revisión. La intervención varía entre 3 semanas y 12 meses, con sesiones diarias de entrenamiento 2-5 veces por semana, de entre 30 y 60 minutos de duración. La intensidad y el tipo de ejercicio prescrito fueron áreas con una amplia dispersión, favoreciendo la mayoría de los estudios el entrenamiento anaeróbico, de intensidad baja a moderada.

Discusión: La mayoría de los programas se evalúan al inicio, a la mitad y al final del programa, utilizando escalas para medir la calidad de vida, la capacidad cardiorrespiratoria y la funcionalidad. Las características de la intervención, la duración y los instrumentos de evaluación difieren entre los estudios.

Conclusión: Deberían realizarse más investigaciones para conocer el abanico de criterios de frecuencia, intensidad, tipo y duración del ejercicio físico a implementar en personas sometidas a cirugía cardíaca en fase II de RC. La cartografía de las intervenciones que podrían utilizarse en los programas de RC de fase II podría ayudar a determinar los principales componentes que deben tenerse en cuenta en los programas de intervención, para una toma de decisiones informada por parte de la enfermería de rehabilitación, así como a identificar las áreas prioritarias de investigación.

Descriptores: Cirugía cardíaca, Rehabilitación, Calidad de vida, Terapia de ejercicio

INTRODUCTION

Increased average life expectancy is causing the number of chronic diseases to increase[1]. The incidence of cardiac pathology has been increasing, and in Europe it is 3/1000 people/year, while the prevalence follows the same trend, increasing as age advances[2].

Cardiac surgery is one of the eligible treatments in cardiac pathology and patients proposed for surgery gradually present at an older age, related to the increase in survival. This phenomenon entails greater risks for the postoperative period, as well as for the intraoperative period because the patient usually manifests more comorbidities, which entails an even greater challenge and burden for the health system[3].

Therefore, the needs expressed by individuals affect multiple domains, such as physiological, autonomy, psychological, social, and information areas[4]. After surgery, patients may face some physical and psychological complications such as fatigue, pain, respiratory complications, immobility, sleep disturbances, and high levels of anxiety and depression, which influences their functional capacity and quality of life[5].

In response, after surgery, rehabilitation acts in the secondary prevention of cardiovascular disease, responding to problems caused not only by the disease but also by potential consequences exacerbated by

surgery. Considering the above, cardiac rehabilitation (CR) aggregates a set of intervention areas such as nutritional counseling, modification of cardiovascular risk factors, psychosocial interventions, and physical activity counseling. It aims to implement interventions adjusted to the individual's need to regain strength, prevent the worsening of the condition, reduce risks, and improve health and quality of life[6]. It is subdivided into three phases, where phase I corresponds to the period of hospitalization after the cardiac event; phase II to the period immediately after hospital discharge; and phase III corresponds to the maintenance period[6].

Rehabilitation after cardiac surgery should be started as early as possible, and recommendations suggest that in phase II it should be maintained and optimized. Physical exercise immediately after hospital discharge has positive effects on the prevention of pulmonary complications and on the person's functionality[6]. The synthesis of the core components of the prescription of physical exercise for this population in phase II CR is relevant for nurses.

In this sense, the structuring of programs aimed at the needs of people who have undergone cardiac surgery after hospital discharge should include a set of interventions, where education and physical exercise play a key role [7]. For this reason, the present scoping review (ScR) intends to focus its attention mainly on the components of physical exercise in people who have undergone surgery.

Thus, the physical exercise aims to improve functional capacity and quality of life through a set of planned, structured, and repeated body movements according to the characteristics of each individual[8-11].

Considering the importance of exercise in this context, this ScR aims to analyze and map phase II CR programs that include individuals who have undergone classical cardiac surgery, focusing on the core components of physical exercise. Hence, this review aims to answer the following question: What is the scientific knowledge produced regarding the influence of rehabilitation programs focused on physical exercise on the functionality and quality of life of people undergoing cardiac surgery?

METODOLOGY

An ScR was performed using the Joanna Briggs Institute® guidelines [12, 13] and the protocol is registered in OSF Registries, accessible at https://osf.io/dv8nz/.

In the development of the present study, the following steps were conducted: definition of the research strategy; identification and selection of relevant studies, with no time limit; data extraction; analysis of the evidence; and presentation of the results [14].

The Participants, Concept, and Context (PCC) strategy was used to outline the search strategy. Thus, the present ScR included studies that included adults who had undergone cardiac surgery, namely valvular surgery or coronary artery bypass grafting (P); whose concept described rehabilitation interventions focused on physical exercise with influence on functionality and quality of life (C); and developed in hospital and home settings, in any country (C). Based on the strategy described above, the following research question was defined: What is the scientific knowledge produced concerning the influence of rehabilitation programs focused on physical exercise on the functionality and quality of life of people undergoing cardiac surgery?

The following eligibility criteria were defined: studies of any level of evidence; inclusion of gray literature; research with no time limit, studies that clearly describe the intervention performed in phase II of CR and that in their target population include individuals undergoing coronary artery bypass grafting and heart valve surgery; studies in Portuguese, English, and Spanish.

Considering the recommendations of JBI ® [12, 13] the research strategy outlined consisted of three stages. The first included a search in MEDLINE (via PubMed) and CINAHL databases for the keywords initially defined (MesH terms), followed by an analysis of the title, abstract and index terms of the texts obtained and the identification of new descriptors. Subsequently, in the structuring of the search strategy, a combination of the words and terms obtained was carried out, with a subsequent search for the Boolean phrase in all data sources included. This was done by searching by title, abstract, and index terms. The gray literature search was also included, according to the strategy defined by the JBI®. Finally, the bibliographic references of the studies selected in the full-text stage were analyzed to select additional sources that had not been identified in the initial search. In this review, studies written in English, Spanish, and Portuguese were included, regardless of the year of publication. The selection process of the studies, as well as the last search, occurred in November 2022, and the search strategy is shown in Table 1.

Table 1 - Search strategy with Boolean operators

Acess	Data source	Search strategy
EBSCOHost	CINAHL Complete	TI ((“Cardiac surgery” OR “Heart surgery” OR “Heart valver surgery” OR “Myocardial revascularization” OR “Coronary artery bypass”) AND (“Exercise therapy” OR rehabilitation OR “Comprehensive health care” OR program* OR guideline OR protocols OR intervention*) AND (“nurse-led intervent*” OR “nurse-led clinic*” OR “nurse pratice pattern*” OR nurs*) AND (autonomy OR independency OR functioning OR “Quality of life”)) OR AB ((“Cardiac surgery” OR “Heart surgery” OR “Heart valver surgery” OR “Myocardial revascularization” OR “Coronary artery bypass”) AND (“Exercise therapy” OR rehabilitation OR “Comprehensive health care” OR program* OR guideline OR protocols OR intervention*) AND (“nurse-led intervent*” OR “nurse-led clinic*” OR “nurse pratice pattern*” OR nurs*) AND (autonomy OR independency OR functioning OR “Quality of life”)) OR SU ((“Cardiac surgery” OR “Heart surgery” OR “Heart valver surgery” OR “Myocardial revascularization” OR “Coronary artery bypass”) AND (“Exercise therapy” OR rehabilitation OR “Comprehensive health care” OR program* OR guideline OR protocols OR intervention*) AND (“nurse-led intervent*” OR “nurse-led clinic*” OR “nurse pratice pattern*” OR nurs*) AND (autonomy OR independency OR functioning OR “Quality of life”))
	CINAHL Plus with Full Text	
	ERIC	
	Library, Information Science & Technology Abstracts	
	MedicLatina	
	MEDLINE	
	MEDLINE with Full Text	
	Psychology and Behavioral Sciences Collection	
	Academic Search Complete	
	Business Source Complete	
	SPORTDiscus with Full Text	
	Nursing Reference Center	(“Cardiac surgery” OR “Heart surgery” OR “Heart valver surgery” OR “Myocardial revascularization” OR “Coronary artery bypass”) AND (“Exercise therapy” OR rehabilitation OR “Comprehensive health care” OR program* OR guideline OR protocols OR intervention*) AND (“nurse-led intervent*” OR “nurse-led clinic*” OR “nurse pratice pattern*” OR nurs*) AND (autonomy OR independency OR functioning OR “Quality of life”)
Web of Science Portal	All data bases	(“Cardiac surgery” OR “Heart surgery” OR “Heart valver surgery” OR “Myocardial revascularization” OR “Coronary artery bypass”) AND (“Exercise therapy” OR rehabilitation OR “Comprehensive health care” OR program* OR guideline OR protocols OR intervention*) AND (“nurse-led intervent*” OR “nurse-led clinic*” OR “nurse pratice pattern*” OR nurs*) AND (autonomy OR independency OR functioning OR “Quality of life”)
TRIP Portal	TRIP Database	(“Cardiac surgery” OR “Heart surgery” OR “Heart valver surgery” OR “Myocardial revascularization” OR “Coronary artery bypass”) AND (“Exercise therapy” OR rehabilitation OR “Comprehensive health care” OR program* OR guideline OR protocols OR intervention*) AND (“nurse-led intervent*” OR “nurse-led clinic*” OR “nurse pratice pattern*” OR nurs*) AND (autonomy OR independency OR functioning OR “Quality of life”)
SCOPUS Portal		TITLE-ABS-KEY ((“Cardiac surgery” OR “Heart surgery” OR “Heart valver surgery” OR “Myocardial revascularization” OR “Coronary artery bypass”) AND (“Exercise therapy” OR rehabilitation OR “Comprehensive health care” OR program* OR guideline OR protocols OR intervention*) AND (“nurse-led intervent*” OR “nurse-led clinic*” OR “nurse pratice pattern*” OR nurs*) AND (autonomy OR independency OR functioning OR “Quality of life”))

Acess	Data source	Search strategy
Grey Literature	OpenGrey	3 separate surveys: Cardiac rehabilitation Cardiac surgery rehabilitation Exercise therapy in cardiac surgery
	Repositório Científico de Acesso Aberto de Portugal (RCAAP)	2 separate surveys Cardiac surgery rehabilitation Exercise therapy in cardiac surgery

The studies obtained in each of the databases were exported to a reference management software (Endnote X9®) and duplicate references were removed.

The eligibility of the articles for review was analyzed by two independent reviewers, by analyzing the title and abstract and, finally, the full text. In case of disagreements between the investigators, these were resolved by a third investigator, responsible for deciding the inclusion or not of the study in question. The articles resulting from the first screening were submitted to the inclusion criteria using a Relevance/Eligibility Analysis Instrument adapted for this purpose.

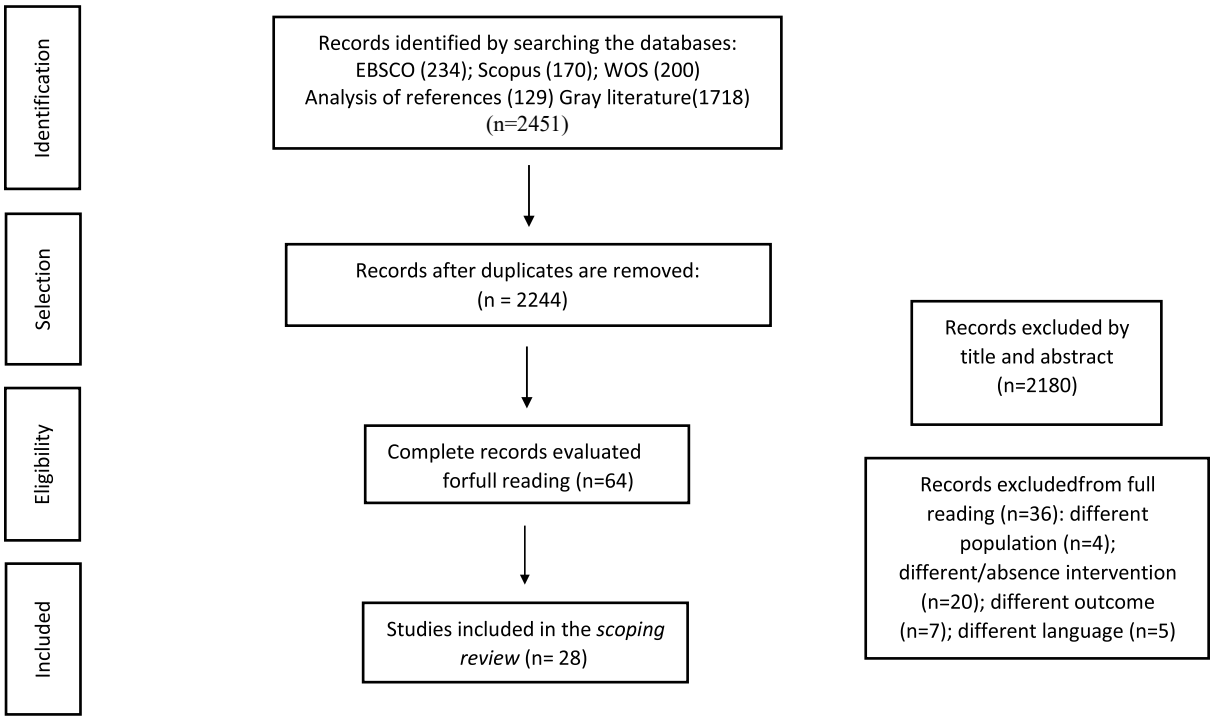
For data extraction, an instrument was designed to record the main characteristics of the studies, as well as the main evidence found. Thus, it included the following topics: the author and year of publication, the title, the type of study, the setting and context, the study objectives, the intervention (describing the frequency, intensity, time, and type of intervention), and the assessment (including the moments and resources for its implementation). The data obtained were presented in tables and reflected, grouping them into conceptual categories.

The authors of the primary studies were contacted for further information and/or clarification of the data where necessary. Aiming for the quality of the output of this Scoping Review was based on the PRISMA checklist[15].

RESULTS

As shown in Figure 1, the search of the data sources identified 2451 potentially relevant studies, with 604 originating from the EBSCO aggregator and the WOS and Scopus databases. Among the remainder, 129 were obtained from the analysis of references and 1718 from the gray literature. Thus, after analyzing the title and abstract, 2244 articles were excluded, leaving for full analysis 64 studies, of which 28 articles were included in this review.

Figure 1 - Prisma Flowchat (adapted) of the study selection process



From the full-text reading of the articles, 36 were excluded because they did not include individuals undergoing cardiac surgery in the sample (n=4), the programs were not exercise- oriented (n=9), phase II CR was not addressed (n=3), the exercise program was not described (n=8), the indicators under analysis were not measured (n=7) or they were written in a language other than Portuguese, English or Spanish (n=5).

The 28 articles included in the full analysis differ in the year of publication, so they are between the years 1998 and 2021, with the majority published from 2010 onwards (64%). As for the type of study, randomized controlled trials (n=18), randomized controlled trial protocols (n=3), and quasi-experimental studies (n=7) were included. All studies under analysis included patients undergoing surgeries such as coronary artery bypass grafting, although 8 articles also included patients undergoing valve surgery. The programs took place in outpatient settings (n=14), at home (n=7), or with the patient hospitalized for the rehabilitation program (n=4).

The programs included in the review showed a wide geographic distribution, with most taking place in Europe, followed by North America, and finally in countries such as Brazil, Japan, Australia, Tunisia, and Iran. The number of participants per study was diverse, ranging from 9 to 1902 participants.

The 28 studies that made up the sample were analyzed according to the defined eligibility criteria. However, some of the studies included did not define aspects related to the Frequency, Intensity, Time, and Type of Intervention (FITT) criteria items, namely exercise intensity and time.

Regarding the FITT criteria, the frequency of training sessions varies from bi-weekly to daily, where most of them are 2 to 3 times a week. The duration of the programs in the included articles is a minimum of 3 weeks and a maximum of 12 months, with a mode of 12 weeks. The start of the intervention program ranges from immediately after hospital discharge to one and a half months after surgery.

The training intensity in the articles included in the analysis was calculated in different ways, namely, through the perceived exertion, measured using the Borg scale; the maximum heart rate; the basal heart rate, and the power of the cycle ergometers. The number of sets of each exercise varied between 2 and 3 and the number of repetitions of each set was between 8 and 15.

The time item refers to the duration of the intervention sessions of the programs described in the articles included in the analysis, where the minimum duration is 30 minutes and the maximum is 120 minutes, where the mode is 60 minutes.

The type of intervention, according to American College of Sports and Medicine[8] defines the components of the prescribed exercise program. In the included studies, the training sessions include a warm-up phase, aerobic[16-38] and anaerobic training[26, 27, 29, 31, 38-43] phase, and relaxation/stretching phase. In addition to the exercise training, the participants fulfill health education sessions through multidisciplinary intervention.

The assessment of the results obtained from the different programs varies according to the specific objectives of each study included in the analysis, although most of them are related to the use of metric values (heart rate (HR), peripheral oxygen saturation, blood pressure), the use of quality of life assessment scales (SF-36, HRQoL), cardiorespiratory capacity (6-minute walking test (MWT)), functionality (Barthel Index) and anxiety and depression (Hospital Anxiety and Depression Scale - HADS). The evaluation of the intervention programs is done in two moments, at the beginning and the end of the intervention; although there are cases[21, 37, 40, 42] where mid- term evaluations are done months after the end of the intervention program.

DISCUSSION

The purpose of this ScR was to analyze and map phase II CR programs, with a focus on exercise, that included individuals undergoing classical cardiac surgery.

To meet this objective, 28 articles were included in this review, 18 of which were experimental studies, 7 quasi-experimental studies, and 3 protocol studies. Based on the analysis of the type of studies, it is clear that there is research interest in the area, and that the amount of information on the topic is significant, although it is diverse, unsystematized, and varied in terms of study designs.

CR targets individuals with a history of acute myocardial infarction (AMI), Coronary Artery Bypass Graft (CABG), Percutaneous Cardiac Intervention (PCI), stable angina pectoris, valvular surgery (percutaneous approach or sternotomy), heart transplantation, and heart failure with reduced ejection fraction[8]. When analyzing the characteristics of the samples of the studies, one notices that they include individuals with a wide variety of pathologies, as well as a set of invasive interventions, whether surgical or percutaneous. In this sense, few studies aim to study the influence of physical exercise on the quality of life and functionality of individuals undergoing valve surgery, as can be seen by the results obtained by the studies that include patients undergoing heart valve surgery (n=4), as recommended by Abraham, Sibilitz[44] in their review study.

The context where the studies take place refers to programs that take place at home, outpatient, or mixed regimes, including institutions such as rehabilitation centers. Thus, to define the rehabilitation

program at home, it is necessary to take into account aspects such as the stratification of the risk of cardiovascular events, the possibility of monitoring, and the adherence of the participant to the program. Home-based CR programs are indicated for individuals at low and moderate risk and should provide a set of incentives for adherence and maintenance of the exercise plan[45]. Among the included studies, 6 are exclusively in home-based settings, and some of the implementation strategies have been described, such as the use of online platforms, home visits, telephone contacts, and video conferencing[16, 21, 33, 37, 46].

PHYSICAL EXERCISE IN REHABILITATION PROGRAMS

The exercise prescription, which encompasses the planning and implementation phase, should be based on a set of premises such as the objectives, content/components, method, intensity, duration, and frequency of exercise[10]. Considering these aspects, the American College of Sports and Medicine[8] defines that each session includes the warm-up phase, the exercise training phase, the cool-down and stretching. The studies included in this ScR include the phases described above, except for those investigating resistance training and muscle strengthening [26, 39, 42].

To systematize the analysis of the programs included in the review, we used the mnemonics of the FITT criteria, that is, the frequency of training, the intensity, the time, and the type. It was not possible to describe these items in all the articles analyzed, as they were omitted in some records. On the other hand, from the analysis of the results, it is clear that for each FITT criterion, there is a dispersion regarding the data obtained, which is relevant for discussion. In this sense, Pengelly et al [47] mention that there is significant variability concerning the prescription of exercise frequency, intensity, and duration of the program and training sessions.

Regarding the frequency of intervention program, among the studies included in the review it is perceived that the most frequent is 2 to 3 times per week, however Pelliccia et al [48] mention that individuals with heart disease should exercise as many days a week as possible and a minimum of 150 minutes a week. The duration of the programs under review have a wide range, as they last from 3 weeks to 12 months after a cardiac event, with the majority at 12 weeks. This dispersion reflects the position of Price et al [49] which highlights that the level of surveillance of exercise training depends mainly on the accessed risk level, but the exercise practice should be maintained after cardiac event.

The studies included in the review advocate that programs begin immediately after hospital discharge up to 1.5 months after discharge, however, Niebauer[10] advocates the need for exercise training to begin 2 to 4 weeks after surgery since until this time the patient is more focused on respiratory rehabilitation and therapy adjustment.

The intensity of training was the parameter under analysis with the least information in the studies included even so, from the data obtained, it is understood that there is a relationship between the type of training recommended and its intensity. To define the intensity of the exercise, the perceived exertion scale (Borg scale), the VO2, and heart rate (maximum and baseline) were used, thus determining the objectives of the exercise. For a selection of training intensity, the American College of Sports and Medicine[8] recommends that it should be adjusted according to light, moderate, or high intensity, the type of endurance, resistance, or interval training, and the existence or not of exercise tests. When exercise tests are not available, the exercise prescription should be based on resting heart rate (plus 30 beats per minute or minus 20 beats per minute) and/or using relative perceived exertion (12-16 on a scale of 6 to 20). In these cases, exercisers must monitor for signs and symptoms of exercise intolerance such as excessive fatigue, dizziness, tachycardia, and signs and symptoms of cardiac ischemia[8, 48]. Its important to look to these signs as safety criteria for implementing physical exercise, namely in cardiac patients.

The number of repetitions for muscle strength training is different in the different programs under analysis, varying according to the training objective, the muscle groups to be worked, and the conditioning of individuals. Ideally, in adults, the training of each muscle group should include 2 to 4 sets with 8 to 12 repetitions, with a rest interval of 2 to 3 minutes between sets to improve muscle strength[8].

The duration of the training sessions, among the studies included in the research varies between 30 and 120 minutes, with the most frequent being 60-minute sessions. The studies included defining the training session plan according to the exercise guidelines[8]. However, they do not define the timing of each step of the training session, according to the American College of Sports and Medicine[8] recommendations warm-up should last 5 to 10 minutes, aerobic/anaerobic training 20 to 60 minutes, cool-down 5 to 10 minutes, and stretching 10 minutes. The duration of the sessions should be appropriate depending on the type of training and the intensity - light, moderate or vigorous[8, 45, 50]. The intensity of training level definition (light, moderate or vigorous) depends mainly of the heart rate reserve or oxygen uptake reserve.

Most of the articles included in the study developed programs that include the different stages of training already described, specifying aerobic training, using a cycloergometer, static bicycle, treadmill, or walking. Resistance training is less

frequent, and whenever it is included, the exercises are calisthenics or using weights, without defining the load. The implementation of resistance training using weights is part of the international guidelines[8] for exercise testing and prescription, however, in the specific case of cardiac surgery with sternotomy, the American College of Sports and Medicine[8] mentions that the execution of resisted upper limb lifting movements (with load) is not recommended in the first 8-12 weeks, but may be started between 10-12 weeks with weights between 2-5 kg. The upper limb cycloergometer should be encouraged once the pain is controlled [8].

The evaluation of the intervention programs included in the review is performed at the beginning and at the end of the intervention, with some of them recommending interim evaluations and in certain periods, namely 6 and 12 months after the end of the program. Regarding the parameters evaluated, they vary according to the objective of the study, even so, in a transversal way, they evaluate the quality of life (SF-36 and EuroQol), functional capacity (6MWT and VO2 test), anxiety and depression (HADS), perception of effort (Borg Scale), and metric values (HR, blood pressure, oxygen saturation), the latter being evaluated during the training sessions.

International recommendations for evaluating the effectiveness of CR programs advocate resources such as quality of life assessment scales like the Medical Outcomes Study Short- Form Health Survey (SF-36) or the MacNew Heart Disease Health-related quality of life Instrument (MacNew); functional capacity assessment using the 6MWT or Short performance battery; and muscle strength using grip strength measured with a dynamometer[47]. During training sessions, the exercise prescription is low to moderate intensity, with the monitorization of HR, blood pressure, oxygen saturation, and perceived exertion using the Borg scale being recommended by Price et al[49].

REHABILITATION PROGRAM EDUCATION AND ADHERENCE

Using technology to implement CR programs at home has a positive impact on program engagement and adherence. Depending on the resource used - websites, phone apps, text messaging, accelerometers, and other devices it is possible to monitor participants' exercise[51].

The possibility of CR programs, particularly the physical exercise component, occurring at home is a strategy that promotes adherence minimizing a set of constraints for the individual. Thus, the individual can exercise without the need to go to a rehabilitation center, and the possibility of having a flexible schedule, reduced costs, and guaranteed privacy[45, 52].

CR programs requires a set of information, which is why most of the articles included in the review recommend health education sessions that address topics such as management of cardiovascular risk factors, stress management, smoking cessation, and nutritional and exercise counseling. In this sense, it is essential that the person undergoing cardiac surgery in exercise programs be capable to recognize the alarm signs, symptoms and finally manage autonomously their own life[49].

Thus, in parallel with physical exercise, it is essential to work on knowledge aspects, i.e., to empower the patient to be able to manage their exercise regime. Thomas et al[45] advocate the need for CR to work on aspects such as patient assessment, exercise, dietary advice, management of cardiovascular risk factors (tobacco, cholesterol, blood pressure, weight, and diabetes), and psychological intervention. In this regard, Ma et al[16] concluded that emotional and information support improved participants' self-management, increased confidence, improved physical function and quality of life. The studies included in this review, although focusing on physical exercise, mostly include education sessions, where they focus on the aspects mentioned in the literature[45].

Home-based CR, besides increasing the number of participants in the programs, has positive effects on behavioral change, by the adoption of healthy lifestyles. Rehabilitation in this context is based on premises such as the empowerment and self-management of the rehabilitation process, through the provision of information support tools (leaflets or computer applications) and, simultaneously, remote monitoring by the health professional.

LIMITATIONS AND IMPLICATIONS FOR PRACTICE AND RESEARCH

In the present review, we only included articles published in English, Portuguese, and Spanish, excluding other languages that might be relevant to this review.

From the research perspective, we suggest more quantitative research studies whose target population is patients undergoing cardiac surgery, specifically valvular and coronary artery bypass graft surgery, in order to improve the suitability and specificity of exercise for this population. Since there are RCTs in the area of the cardiac patient, it would be pertinent to develop level I research (systematic review of literature and meta-analysis).

Thus, it is important to understand the relevance of studying groups with the same pathology/surgery, to assess the most effective programs for each one of them.

CONCLUSION

The objective of this ScR was to map and analyze phase II CR programs that included patients undergoing classical cardiac surgery, and the physical exercise interventions were scrutinized, as well as their prescription based on frequency, intensity, time, and type. Thus, 28 studies were identified with great variability in the design of the CR programs, partly justified by the dispersion in terms of the population to whom they were addressed and by the fact that the exercises prescribed were of low to moderate intensity.

Therefore, the description of main core of the cardiac rehabilitation programs of people submitted to cardiac surgery were synthesized, where the dispersion over the FITT criteria is justified, as the rehabilitation program should be negotiated with the person center of care, including their preferences for exercise, and their clinical data. Other data should be collected such as the presence of caregiver and the housing condition, considering the phase that this ScR analyze.

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