What Factors Determine the Levels of Physical Activity after Cardiac Rehabilitation Program?

Que Fatores Determinam os Níveis de Atividade Física após Programa de Reabilitação Cardíaca?

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ABSTRACT

Introduction: The Cardiac Rehabilitation Programs have gained tremendous importance in the prevention of cardiovascular disease and it's a challenge to ensure the practice of regular exercise during and after the supervised program. The aim of this study was to determine the factors that influence the physical activity habits at 12 months after the Cardiac Rehabilitation Program.

Material and Methods: Prospective study, including 580 patients with ischemic heart disease who were consecutively oriented for Cardiac Rehabilitation Program at Cardiovascular Prevention and Rehabilitation Unit of Centro Hospitalar do Porto, between January 2008 and June 2011. Physical activity levels were measured with International Physical Activity Questionnaire which was calculated at the beginning of the program, 3 and 12 months later. The following variables were chosen and tested as potential determinants of physical activity habits of 12 months after program: age; sex; modifiable risk factors; functional capacity (achieved in treadmill stress test); laboratory analysis (HbA1c, lipid profile, C-Reactive Protein and Brain Natriuretic Peptide). A linear regression analysis was carried to identify the significant determinants and to find the best model adjustment.

Results: Advanced age, female gender, functional capacity and low levels of physical activity prior to the Cardiac Rehabilitation Program, as well as a weak evolution of the International Physical Activity Questionnaire during the program were the best univariable predictors of a less favourable evolution of the International Physical Activity Questionnaire during 12 months of follow-up. A multivariable linear regression analysis showed that the best explanatory model included age, gender and evolution of the International Physical Activity Questionnaire during the supervised program (R^2 Adj. = 0.318; f = 60.62, p < 0.001).

Conclusion: The identification of certain subgroups of patients with lower tendency toward physical activity is beneficial to enable timely and individualized strategies to maximize the therapeutic and preventive potential of the Cardiac Rehabilitation Programs.

Keywords: Coronary Disease/rehabilitation; Exercise Therapy; Heart Diseases/rehabilitation; Quality of Life; Rehabilitation; Rehabilitation Centers.

RESUMO

Introdução: Os Programas de Reabilitação Cardíaca ganharam enorme relevância na prevenção de doenças cardiovasculares constituindo um desafio assegurar a prática de exercício físico regular durante e após o fim do programa supervisionado. O objetivo deste trabalho foi determinar os fatores que influenciam os hábitos de atividade física 12 meses após um Programa de Reabilitação Cardíaca.

Material e Métodos: Estudo prospetivo abrangendo 580 doentes com cardiopatia isquémica consecutivamente orientados para Programas de Reabilitação Cardíaca na Unidade de Reabilitação Cardiovascular do Centro Hospitalar do Porto, entre Janeiro de 2008 e Junho de 2011. Avaliaram-se os níveis de atividade física através do International Physical Activity Questionnaire realizado no início do programa, aos 3 e 12 meses depois. Foram testados como potenciais determinantes dos hábitos de atividade física a longo prazo: idade; sexo; fatores de risco modificáveis; capacidade funcional (alcançada em prova de esforço); análises laboratoriais (HbA1c, perfil lipídico, Proteína C Reativa e Peptideo Natriurético Cerebral). Realizou-se análise de regressão linear para identificar os preditores significativos e encontrar o melhor ajuste do modelo.

Resultados: A idade avançada, género feminino, a capacidade funcional, níveis de atividade física baixos previamente ao Programa de Reabilitação Cardíaca e uma fraca evolução do International Physical Activity Questionnaire durante o programa foram os melhores preditores univariáveis de uma evolução menos favorável do International Physical Activity Questionnaire nos 12 meses de *follow-up*. A análise de regressão linear multivariável concluiu que o melhor modelo explicativo incluía: idade, género, evolução do IPAQ no programa (R^2 ajust = 0,318; f = 60,62; p < 0,001).

Conclusão: A identificação de subgrupos de doentes com menor tendência à prática de atividade física permite desenvolver estratégias individualizadas, maximizando o potencial terapêutico e preventivo dos Programas de Reabilitação Cardíaca.

Palavras-chave: Centros de Reabilitação Física; Doença Coronária/reabilitação; Doenças do Coração/reabilitação; Qualidade de Vida; Reabilitação; Terapia por Exercício.

INTRODUCTION

Cardiac Rehabilitation Programs (CRP) have been accepted as essential components of cardiovascular disease (CVD) treatment in last decades, and are currently recommended for patients post Acute Coronary Syndrome (ACS),[1,2] unstable angina,[3] cardiac failure,[4] coronary artery bypass surgery (Coronary Artery Bypass Graft - CABG)[5] or percutaneous coronary intervention - PCI[6] and cardiac transplant.[7]

Favourable results on multiple variables are described in literature[8]: increasing functional capacity,[9] control of

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lipid and glucose profile,[10] Body Mass Index (BMI), blood pressure and a reduction in inflammatory parameters,[10-15] improvement of psychological and health quality factors;[16,17] decrease of hospital readmissions,[18] morbidity and mortality related with cardiac pathology,[19-22] with additional evidence of an economic benefit for healthcare. Despite all benefits, patient referral for CRP remains extremely low, with less than 3% of eligible patients attending a CRP in Portugal.[23]

CRP efficacy is partly established by its organization and dynamics, in which the patient is encouraged to participate actively in his rehabilitation process, aimed for early community reintegration. The information provided to the patient regarding his disease, cardiovascular risk factors (CVRF) and CRP objectives is also important to reach the desired success regarding risk profiles closely related with morbidity and mortality.

One of the major challenges for health professionals involved in Cardiac Rehabilitation is changing patient's lifestyle, encouraging, among others, regular physical activity, emphasizing its importance in cardiovascular disease prevention. Adherence to physical activity has been a factor related with a 20 to 30% reduction in total mortality of patients with a known cardiovascular disease.[24] Nevertheless, few studies describe adherence to physical activity during CRP and its long-term maintenance after exercise is no longer supervised. The level of weekly physical activity may be estimated using several methods, including self-completed questionnaires. The International Physical Activity Questionnaire (IPAQ) is validated for the Portuguese population and is aimed to quantify (in MET. minute/week) the physical activity completed over one week, in different contexts of daily activities (namely home, occupational, sport and recreational activities).[25] It has been used in Cardiac Rehabilitation as an assessment instrument of levels of physical activity completed by patients included in a program.

The aim of the present study was assessing determinant factors of physical activity progress over 12 months after attending a CRP.

MATERIAL AND METHODS

This prospective study was carried out in 580 consecutive patients with ischaemic heart disease referred for CRP to the Cardiovascular Rehabilitation and Prevention Unit (*Unidade de Prevenção e de Reabilitação Cardiovascular* (UPRCV)) of the *Centro Hospitalar do Porto*, between January 2008 and June 2011. It only included patients in whom a maximum three-month period had elapsed after the event on which hospital admission was based and the referral to the program. From the initial group of patients, 195 were excluded due to program dropout, clinical Complications leading to dropout and data omission during the follow-up period. Therefore, 385 patients who completed the CRP were included, without data omission regarding the parameters that we aimed to assess.

We established three timepoints in the assessment: at the beginning of the CRP and after 3 and 12 months.. The initial assessment included the patient's medical history and physical examination, focused on cardiovascular, musculoskeletal and neurological system, as well as clinical data and socio-demographic characteristics. Data regarding patient's risk profile were collected at the set timepoints: blood pressure assessment using a upper arm digital sphygmomanometer (the average between two values obtained upon a period of five minutes rest); anthropometric data including Body Mass Index (Kg/ m2), Abdominal Circumference and Hip Circumference, obtained with an extensible measuring tape with the patient in standing position, smoking behaviour; blood glucose, HbA1c levels and lipid profile (obtained upon a 12-hour fast), including total cholesterol (TC), LDL-cholesterol (LDL-C – *low density lipoprotein cholesterol)*, HDL-cholesterol (HDL-C – *high density lipoprotein cholesterol*) and triglyceride (TG); C-reactive protein (CPR) and brain natriuretic peptide (BNP).

At the set timepoints, patients performed an Exercise Tolerance Test (ETT) using a motorized treadmill, while on maintenance medication, allowing for the measurement of chronotropic and haemodinamic parameters. Maximum functional capacity was estimated in MET obtained by the ETT, calculated using American College of Sports Medicine (ACSM) metabolic equations for treadmill exercise.[26]

Physical activity level assessment was obtained through IPAQ (International Physical Activity Questionnaire), measured in MET.minute/week and categorized according to the following cut-off: under 600 MET.minute/week for low physical activity level (sedentary lifestyle), 600-3,000 MET. minute/week for moderate physical activity level; above 3,000 MET.minute/week for high physical activity levels. This questionnaire was applied on the set timepoints. The initial questionnaire was completed on the second day of admission at the Cardiology Department and referred to the patient's physical activity behaviour before the cardiac event.

Intervention

The CRP was implemented in our Hospital according to the European Society of Cardiology (ESC)[27] and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) recommendations,[28] including psycho-educational group sessions, individualised counselling regarding CVRF control strategies (including nutritional assessment) and supervised physical exercise sessions.

With a duration that varied between 6-12 weeks (determined according to individual, socio-occupational and clinical factors), these sessions take place twice a week at the UPRCV, with the presence of a physiatrist and a cardiologist, following international recommendations as regards supervision and monitoring levels individually tailored to each patient.[29] Each session lasts between 60 and 90 minutes, following an exercise protocol with the following stages: warm-up, aerobic training (treadmill and upper/lower body cycle ergometer exercise), strength training (using

dumbbells, medicine balls and the muscle strengthening machine), cooling/relaxation and musculotendinous flexibility exercises. The intensity of each exercise activity was individually determined, based on the Heart Rate Training (HRT) obtained with the Karvonen formula,[26] using data obtained in the tolerance tests; it was complemented with the subjective perceived exertion recorded with the Borg scale.[29] A ECG monitoring by telemetry was carried out during the sessions, complemented with the use of heart-rate monitors by the patients, the intensity of the exercise being periodically adjusted as required (aiming to 50-80% of the chronotropic reserve).

In addition, physical activity was encouraged in all patients during the other days of the week, based on general prescription principles and with the objective of promoting a safe increase of physical activity. The prescribed plan of exercise included 40-60 minutes of moderate daily physical activity, with similar parameters as those applied during the supervised sessions, namely the HRT (obtained by the patient with the monitor) and the subjective perceived exertion (11 - 'fairly light' to 13 – 'somewhat hard' in Borg scale).

Statistical Analysis

The data statistical processing used SPSS software version 19, parametric and non-parametric tests of paired samples and univariate and multivariate linear regression analysis. The linear regression analysis used the difference of IPAQ score at the beginning and at 12 months as a dependent variable. The choice of predictor variables was based on the comparison between the best adjustment of the models created, upon diagnostics of influential observations and confirmation of the necessary prerequisites for linear regression.

RESULTS

Our study included 385 patients, with a male predominance (76.1%), aged between 30 and 84. Of these, 66.8% of the patients were admitted with an ACS diagnosis. Characteristics of our group of patients are presented on Table 1.

In the beginning of the CRP, according with the results of the IPAQ, 50.4% of the patients reported a low level of weekly physical activity. Females and those patients with cardiac failure as the admission diagnosis were those who presented the lowest IPAQ scores. The reported levels of physical activity according with the age groups are presented on Fig. 1. Functional capacity (in MET, estimated in the initial ETT) is presented in Fig. 2, from which we may obtain lower values in the older age groups.

A global increase in weekly physical activity level (+ 204%; $p < 0.001$) as well as in functional capacity, obtained by the ETT performed at the end (+17%; $p < 0.001$) was evident throughout the CRP (Fig. 3 and 4). The subgroups who presented the most marked increase in IPAQ results were the sedentary patients (with scores under 600 MET. minute/week), those who were admitted with a Stable Angina diagnosis and those aged 60 to 69 (Table 2, 3 and 4). There were no significant differences between genders (Table 5). The elderly patients, mainly over 80, presented the worst increases in IPAQ scores.

An the assessment at 12 months, we observed a decrease in the average IPAQ scores, when comparing with those recorded at the end of the CRP (-20%; $p < 0.001$).

Table 1 - Characteristics of our group of patients at admission to the CRP

Age. average (SD)	**60.41 ± 10.86**
Gender	
- Male	293 (76.1%)
- Female	92 (23.9%)
Diagnosis at admission	
- Acute coronary syndrome	257 (66.8%)
- Elective PCI	67 (17.4%)
- Stable angina	20 (5.19%)
- CABG	35 (9.1%)
- Cardiac failure	6 (1.6%)
Cardiovascular risk factors	
- BMI ≥ 25	266 (69.1%)
- Dyslipidemia	260 (67.5%)
- High blood pressure	239 (62.1%)
- Type 2 Diabetes Mellitus	133 (34.5%)
- Tobacco use	116 (30.1%)
- Stress	88 (22.9%)
Levels of weekly physical activity (IPAQ)	
- Sedentary	194 (50.4%)
- Moderate activity	169 (43.9%)
- Vigorous activity	22 (5.7%)

SD – standard deviation; CVRF – Cardiovascular Risk Factors; BMI – Body Mass Index; PCI – Percutaneous Coronary Intervention; CABG - Coronary Artery Bypass Grafting

According to the admission diagnosis, the score decrease varied between 7 and 58%, and was only significant in the subgroup of patients admitted with an ACS diagnosis (-22%; $p < 0.001$). Patients aged 60-80 presented a significant decrease of the IPAQ score, with a higher difference in female patients. The patients that presented previous levels of physical activity over 3,000 MET.minute/week maintained the level described (at the end of CRP) at the 12 months assessment. .

Older age, female gender, which functional capacity and previous low levels of physical activity before the program, as well as a slow increase in IPAQ scores during the CRP were the best univariate predictors of a less favourable progress in the IPAQ score throughout the 12 months of follow-up (Table 6). Multivariate linear regression analysis allowed for the conclusion that the best explanatory model included patient's age, gender and IPAQ score progress during the CRP (adjust $R^2 = 0.318$; $f = 60.62$; $p < 0.001$). All the other variables included in the linear regression model did not present statistical significance.

DISCUSSION

In our study, involving 385 patients, we observed a significant increase in the levels of weekly physical activity after CRP in all patients, regardless of age, gender or underlying disease. Previously sedentary, male patients or those with stable angina as the admission diagnosis presented the best results. The assessment at 12 months showed a slight but significant decrease of the IPAQ score, yet maintaining a higher average score than at the beginning of the program, reinforcing the long-term impact of the CRP in the lifestyle of these patients. The subgroup analysis allowed for the conclusion that a decrease in the IPAQ scores at 12 months was more evident in the patients with a stable angina and in female. The linear regression analysis allowed for the conclusion that certain characteristics at the beginning of the CRP, as older age, female gender, a low IPAQ score or low MET obtained in the ETT are predictors of a less favourable progress of the levels of physical activity throughout the first year upon the event. The most adjusted regression model that included the variables age, gender and IPAQ evolution during the CRP explains the IPAQ variation in 31.8% of the patients in the first 12 months.

The literature survey showed only two similar studies. Ades et al[30] observed that, at admission for CRP, older age, female gender, low functional capacity, presence of medical comorbidities and depression were predictors of

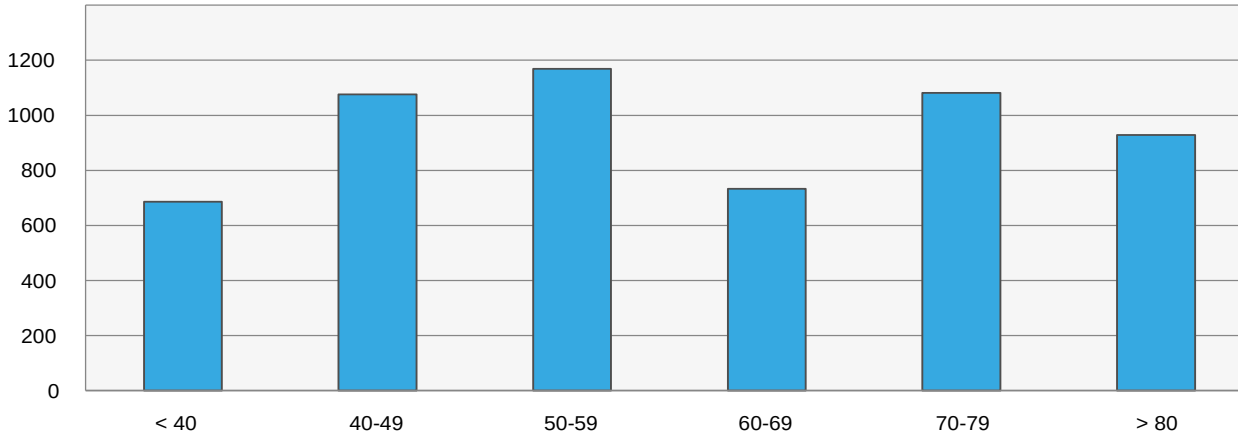

Figure 1 – IPAQ score according with age groups

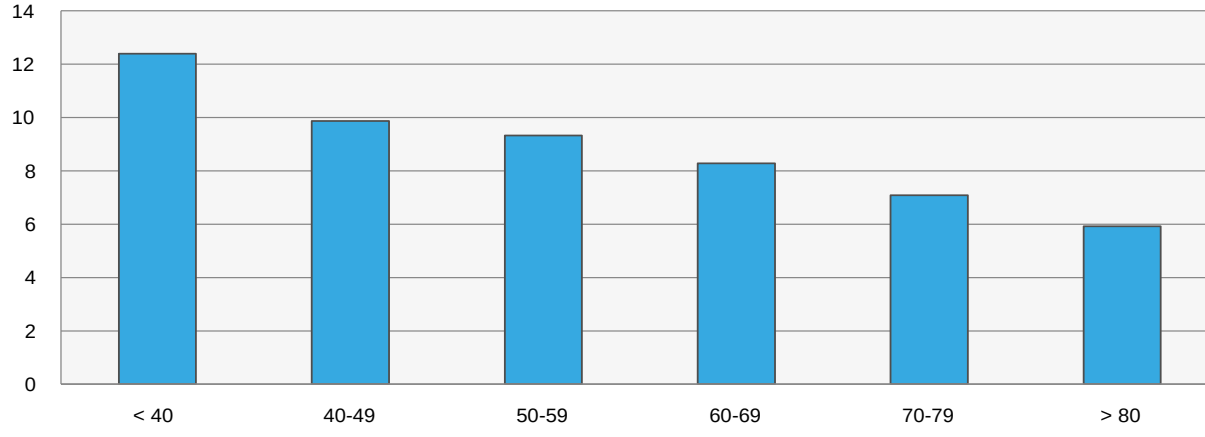

Figure 2 – Functional capacity according with age groups

initial low levels of physical activity. Progress of functional capacity and the score of depression during the CRP were the variables predicting levels of physical activity during the program. Schairer et al[31] found that patients over 70, of the female gender or with a BMI over 30 had difficulties in reaching desirable levels of physical activity, even when attending the CRP.

The importance of physical activity took on a new dimension in 1992, when the American Heart Association considered it to be a major risk factor for cardiovascular disease.[32] Since then, several studies analysed the beneficial effects of physical activity on primary and secondary prevention of cardiovascular diseases. There is evidence that physical activity and cardiovascular risk are inversely correlated[33], in association with changes in CVRF, particularly in inflammatory/haemostatic factors and in blood pressure.[34] The presence of a dose-response relationship between physical activity and the cardiovascular risk has been demonstrated. A recent meta-analysis by Sattelmair et al[35] found that patients with levels of physical activity meeting the American guidelines for physical activity practice presented a risk of coronary artery disease 14-20% lower than sedentary patients and although less evident, physical activity was also found to be beneficial for patients not meeting the levels recommended by the guidelines.. As regards the risk of re-infarction, Steffen-Batey et al.[36] found that previously active patients that maintained similar levels of physical activity following myocardial infarction (MI) presented a 60% lower risk of re-infarction than the patients that continued to be sedentary. In addition, patients that increased their level of physical activity presented a risk 78% lower than that of sedentary patients. The evolution of functional capacity also influences the risk of mortality, with an 8-14% decrease of the risk of mortality by each achieved MET, supporting the finding that physical exercise is an excellent supporting treatment in patients with CVD.

Ageing is usually related to multiple comorbidities, namely musculoskeletal, neurological and cardiovascular, with a decrease in functional capacity, subsequently preventing the regular practice of physical activity. In our study, at the beginning of the CRP, the average IPAQ score and MET in patients aged above 60 was slightly lower in comparison to the remaining patients. Nevertheless, although the patient's age and functional capacity are inversely correlated, we did not observe such a tendency between age and the levels of physical activity (Fig 1 and

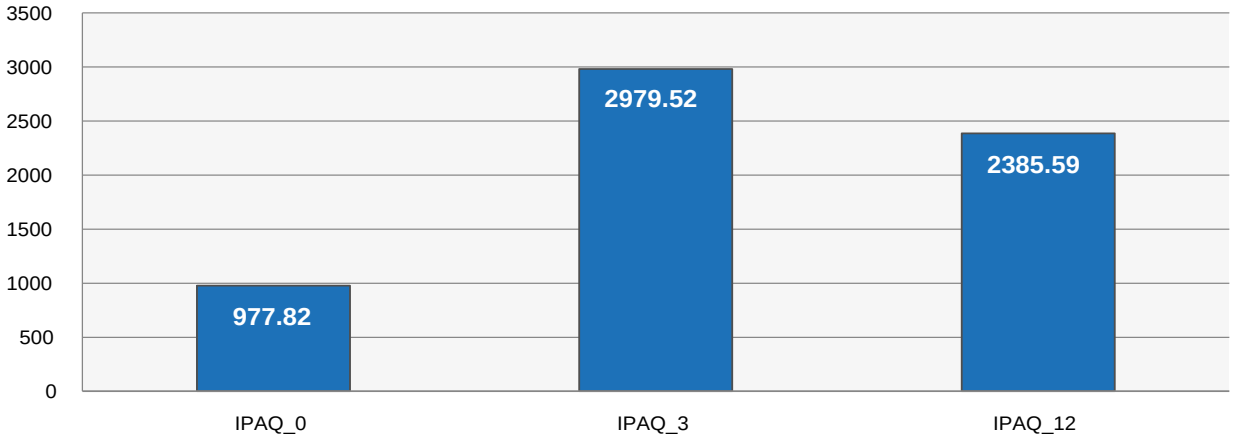

Figure 3 – Evolution of the IPAQ score

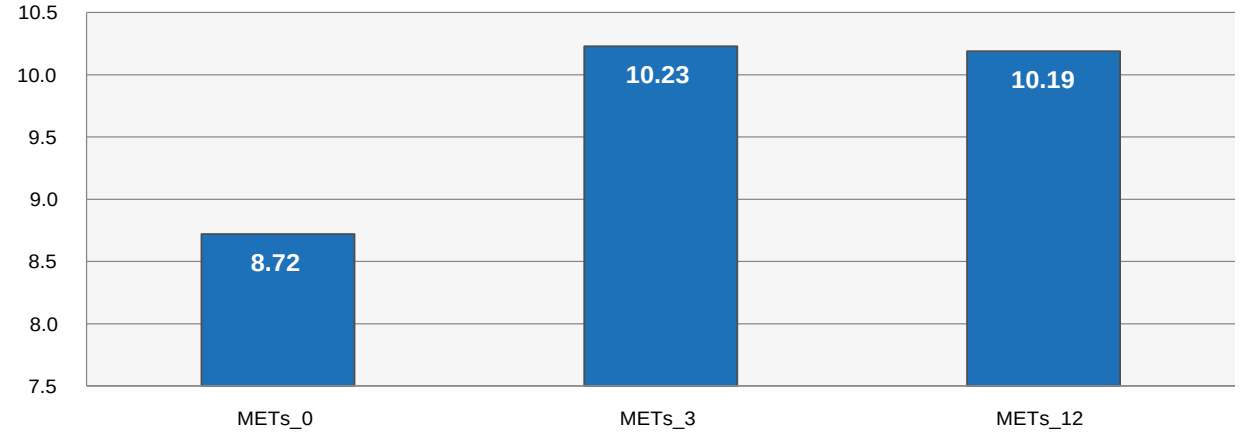

Figure 4 – Evolution of the functional capacity in MET

Table 2 - Evolution of IPAQ score according to the level of physical activity at admission

Level of physical activity	Number of Patients	IPAQ_0	IPAQ_3	Evolution 0-3 months	IPAQ_12	Evolution 3-12 months
Sedentary	194	139.50	2547.61	+1726% ($p < 0.001$)	1878.74	-26% ($p < 0.001$)
Moderate activity	169	1383.14	3142.13	+127% ($p < 0.001$)	2617.46	-17% ($p = 0.001$)
Intense activity	22	5256.68	5539.31	+5% ($p = 0.455$)	5073.93	-8% ($p = 0.528$)

Table 3 - Evolution of IPAQ score according to the diagnosis at admission

Diagnosis	Number of Patients	IPAQ_0	IPAQ_3	Evolution 0-3 months	IPAQ_12	Evolution 3-12 months
ACS	257	1094.33	3009.24	+175% ($p < 0.001$)	2360.29	-22% ($p < 0.001$)
Elective PCI	67	817.68	3076.87	+276% ($p < 0.001$)	2651.31	-14% ($p = 0.134$)
Stable angina	20	575.40	2620.10	+355% ($p < 0.001$)	1495.13	-42% ($p = 0.031$)
CABG	35	767.36	3025.54	+294% ($p < 0.001$)	2732.43	-10% ($p = 0.572$)
CF	6	351.00	1549.25	+341% ($p = 0.043$)	1447.00	-7% ($p = 0.756$)

ACS – Acute Coronary Syndrome; PCI – Percutaneous Coronary Intervention; CABG - Coronary Artery Bypass Grafting; CF – Cardiac Failure

Table 4 - Evolution of IPAQ score according to the age groups

Age group	Number of Patients	IPAQ_0	IPAQ_3	Evolution 0-3 months	IPAQ_12	Evolution 3-12 months
0-39 years	12	685.88	2703.00	+294% ($p = 0.003$)	2360.29	-12% ($p = 0.241$)
40-49 years	49	1075.76	3648.49	+239% ($p < 0.001$)	2651.31	-27% ($p = 0.455$)
50-59 years	113	1168.99	3107.39	+165% ($p < 0.001$)	1638.58	-47% ($p = 0.019$)
60-69 years	125	733.28	3078.55	+319% ($p < 0.001$)	2732.43	-11% ($p < 0.001$)
70-79 years	78	1081.24	2435.51	+125% ($p < 0.001$)	1447.00	-40% ($p < 0.001$)
≥ 80 years	8	928.13	1247.63	+34% ($p = 0.042$)	1228.71	-1% ($p = 0.285$)

2). The more likely hypothesis for this fact is that, although the ageing population reports reasonable levels of physical activity, this is not practised with enough intensity and duration in order to promote the physiological mechanisms that allow for a significant increase in functional capacity. Throughout the CRP, the average IPAQ score from patients aged above 60 changed considerably, with a subsequent decrease. It is interesting to observe that the subgroup of patients aged over 80 years ($n = 8$), besides a significant increase in the IPAQ score during the CRP, presented the lowest reduction at 12 months. (-1%; $p = 0.285$). Although there is some difficulty in encouraging a moderate level of

Table 5 - Evolution of IPAQ score, according with the gender

Gender	Nº doentes	IPAQ_0	IPAQ_3	Evolution 0-3 months	IPAQ_12	Evolution 3-12 months
Male	293	1066.36	3261.04	+205% ($p < 0.001$)	2678.57	-17% ($p < 0.001$)
Female	92	695.84	2082.95	+199% ($p < 0.001$)	1452.52	-30% ($p < 0.001$)

Table 6 - Determinants of the evolution of IPAQ score at 12 months after the CRP

Univariate predictor	Correlation coefficient	R^2	*p*
Age	-0.214	0.046	< 0.001
Gender	-0.180	0.033	< 0.001
METs_0	0.154	0.024	0.003
IPAQ_0	0.338	0.114	< 0.001
Evolution IPAQ 0-3	0.539	0.291	< 0.001

physical activity in these age groups, a decrease of global mortality rate was documented even for lower levels of physical activity, lending support to the importance of including elderly patients in the CRP.[37-39]

Functional capacity and the levels of physical activity tend to be lower in female.[40,41] In the present study, although there was a similar IPAQ score increase in both genders, we observed a 30% decrease in the achieved levels of physical activity at the end of the CRP in females, at 12 months, , when compared with a 17% decrease in male patients. Some psychological and social factors may explain this difference. Female patients may tend to accept the disease as a relentless situation more frequently. Upon the cardiac event, when the acute and sub-acute stages have ended, women recover their occupational activity and their role in family, factors that may reduce time available for practising physical activity. Considering that the role of exercise as a primary prevention factor is even slightly higher in female, this draws the attention for the need to develop strategies aimed at promoting long-term adherence to physical practice in women.

According with 2011 World's Health Organization data, approximately 54% of the Portuguese population do not exercise regularly.[42] At the beginning of the CRP, there were 50.4% of sedentary patients, a similar value to the percentage observed in general population. These sedentary patients should be subjected to careful exercise prescription, due to a reluctance in regular exercise practice that may expected at the initial stages of the CRP. It is crucial to individualize the prescription, adjusting its intensity, its duration and the type of exercise to the patient's preference and functional capacity.

The role of the CRP in the change of physical activity weekly habits is evident in previously sedentary patients, in whom we observe a 1,726% increase of the IPAQ score upon three months of CRP. Nevertheless, the benefits obtained during this period will significantly decrease in the long-term (-26%; $p < 0.001$). Therefore, this subgroup of patients presents a huge potential, in which the therapeutic and preventive effect of Exercise will certainly be more evident. For this reason, at the end of the program, the risks of inactivity should be reinforced, and the patients should be encouraged to perform regular exercise, as there is a tendency to gradually reduce the levels of physical activity, contributing to an increase of cardiovascular risk. The patients with an already high level of physical activity at the beginning of the CRP further increased these levels during the supervised program, keeping the same IPAQ scores throughout 12 months (-8%). Lavie et al.[43] have shown that even the patients with a high initial functional capacity would benefit from CRP, improving their lipid profile and functional capacity.

We commonly observe in clinical practice that patients are reluctant to start a regular and sufficiently intense physical practice after a major cardiac event, in order to reach the desired effects. There is a sense of fear, associated with the myth that physical activity is a deleterious factor for cardiac patients. The CRP aims to raise awareness in patients for the benefits of regular physical activity in the early stages of their recovery. Supervision, monitoring and medical follow-up at the exercise sessions improve a sense of safety and trust as the intensity of the exercise is increasing. The use of self-monitoring systems, such as heart rate monitors, may not only give safety to the patient in his exercise, but also encourage him for practice. Walking, given its safety, accessibility, risk of injuries and proved effects on the mortality rate in cardiac patients, is usually the type of prescribed exercise in patients after a cardiac

event, especially in those patients with reduced previous levels of physical activity and a low functional capacity.[44]

The continuity of a regular exercise program meeting the proposed guidelines/recommendations and determined during a CRP, is usually difficult to ensure. We observed, using heart-rate monitors, that only approximately 50% of the patients adhered to physical activity with the recommended intensity after the CRP, and that adequate levels of physical activity were only met during the days of the CRP and not in the other days of the week.[45,46] Nevertheless, assessments at 2 and 6 years after the CRP concerning the maintenance of the CRP physical activity patterns, have been described.[47,48] This variety of results is partly due to different ways of calculating levels of physical activity (using accelerometers, pedometers, questionnaires) and also due the absence of differentiation between global and recreational physical activity. The protective effect of exercise seems to be more evident when physical activity is followed as a recreational then when it is accomplished as an occupational activity.[49-51] This difference may be explained by the fact that these activities are predominantly anaerobic, with less cardiovascular effect.

It is still controversial which will be the most determinant factor in exercise prescription, whether intensity or duration of exercise. Tanasescu et al.[52] found that both were inversely correlated with the risk of coronary disease. Nevertheless, the intensity showed a more significant effect on the incidence of coronary disease. Yet Manson et al.[53] found that for the same volume of exercise, the decrease of the cardiovascular risk was substantially higher for longer exercises. More recent studies show that a moderate-intense level of physical activity in short periods of time (< 10 min) seems to favourably affect cardiovascular risk.[54]

In our study, the assessment of physical activity weekly levels was carried out using IPAQ, a survey already validated in Portugal for this purpose. Yet, as it is a questionnaire, its major disadvantage is the subjective way in which physical activity levels are assessed, in which the patient describes the type, duration and frequency of a certain activity. Other methods of assessment, providing a higher objectivity, namely using the accelerometers, may be used in the future as a complement of the existing questionnaires.

Constraints of the study

The purpose of this study was to describe progress on levels of physical activity in different subgroups and to identify the determinant factors of the evolution of IPAQ score throughout the first year after a CV event. Statistical analysis aimed to determine several predictors of the IPAQ score for each subgroup, as for instance age, gender or admission diagnosis was not performed. Further studies may establish a relationship between progress in the levels of physical activity and the impact on several cardiovascular risk factors in patients with a recognized cardiovascular disease.

This study that only included patients that fully completed the CRP and these were possibly the most receptive patients to adhere to the indications given by the health professionals. As such, the obtained results are probably biased, as most patients that dropped out the CRP did not reach the desired levels of physical activity. It would therefore be valuable to assess the behaviour of the patients that did not complete the CRP, in terms of physical activity.

CONCLUSION

In this study, age, gender and the progress of the IPAQ score during the CRP were found to be predictor factors of IPAQ score evolution during the first year after a cardiac event. An increase of the levels of physical activity and its maintenance over time is one of the major challenges for professionals responsible for a CRP. These programs are extremely relevant for education and for encouraging regular exercise. The identification of certain subgroups of patients less responsive are beneficial in order to develop timely and individualized strategies aimed to optimize the CRP's therapeutic and preventive potential. Future research should seek to identify other variables that may influence levels of physical activity in this type of population.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest in the writing this manuscript.

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