ARTIGO ORIGINAL | ORIGINAL ARTICLE

Determinantes da alteração do peso corporal em doentes submetidos a reabilitação cardíaca

Predictors of weight change in cardiac rehabilitation patients

Sabrina Pimentel [1] | José Afonso Rocha [2] | Ana Isabel Silva [2] | Fernando Parada [3]

Resumo

Introdução: O excesso de peso e suas consequências associam-se a aumento da morbi-mortalidade cardiovascular. A perda de peso contribui significativamente para a melhoria do perfil de risco cardíaco na prevenção primária e secundária da doença coronária.

Objectivo: Identificar os determinantes da alteração do peso corporal em doentes coronários, integrados num programa de reabilitação cardíaca (PRC) em regime hospitalar (Fase II)

Métodos: Estudo de *coorte* prospectivo com 118 doentes que completaram um PRC nos 3 primeiros meses após síndrome coronário agudo (SCA), recrutados entre Setembro de 2008 e Dezembro de 2009. Dados antropométricos, clínicos, laboratoriais e referentes à capacidade funcional foram obtidos no início e final do programa. O perfil psicossocial e a qualidade de vida foram avaliados através do *Patient Health Questionnaire* (*PHQ-9*) e da *Short-Form 36* (*SF-36*), respectivamente. Foi utilizada a regressão linear univariada para identificar os determinantes da alteração do peso corporal durante o PRC.

Resultados: Foram analisados 118 doentes, que completaram uma média de 14,92(4,32) sessões de treino. Eram maioritariamente do sexo masculino 108(91,5%) e possuíam baixo nível educacional. A perda média de peso e a redução média de IMC foram de 0,73 (2,56)Kg e 0,27 (0,93)Kg/m^2 respectivamente. Na composição corporal, verificou-se uma redução de 1,13%(2,91) na massa gorda e um aumento de 0,45%(1,16) na massa magra. Os determinantes independentes da perda de peso foram nível educacional (b=0,25; p<0,001), hábitos tabágicos aquando do início do programa (abandono: b=-0,35; p<0,001; tabagismo persistente: b=-0,27;p<0,05), sintomas depressivos (b=-0,10; p=0,001; depressão major: b=-1,55; p<0,001) e gasto energético total durante a sessão de treino (b=0,20; p<0,05).

Conclusão: A redução do peso corporal reflecte a adesão a recomendações dietéticas e de actividade física em programas de prevenção secundária, daí ser influenciada pelo nível educacional, hábitos tabágicos, gasto energético total estimado durante a actividade física e factores psicológicos, principalmente depressão. A identificação de factores associados a uma resposta menos favorável do peso corporal pode permitir intervenções mais precoces e individualizadas, tais como combinações mais agressivas de restrição do consumo calórico e elevado gasto energético e intervenções psico-comportamentais. São necessários mais estudos para avaliar o impacto de tais intervenções.

Palavras-chave: alteração do peso corporal, reabilitação cardíaca

Abstract

Background: *Overweight and its consequences are associated with increased cardiovascular morbidity and mortality. Weight loss significantly contributes to improvement in overall cardiac risk factor profile both in primary and secondary prevention of coronary heart disease.*

Objective: *To identify predictors of weight change during a hospital-based phase II cardiac rehabilitation program in coronary patients.*

(1) Resident of PMR; Department of PMR, São João Hospital, Porto, Portugal
(2) Clinical Assistant of PMR; Cardiac Rehabilitation/Exercise Training Unit, Department of PMR, São João Hospital, Porto, Portugal
(3) Director of Department of PMR; Department of PMR, São João Hospital, Porto, Portugal
This study has no disclaimers.
Address and e-mail of first author: Address: Rua Maria Feliciana nº 165, 1º dto; 4465-280 São Mamede Infesta, Porto, Portugal. E-mail: sacapi@hotmail.com

Methods: *Prospective cohort study of 118 patients who completed a phase II cardiac rehabilitation program (CRP) within 3 months after acute coronary syndrome (ACS) recruited between September 2008 and December 2009. Data regarding anthropometric, clinical, laboratorial and functional response was collected at baseline and program completion. Psychosocial profile and quality of life were assessed using Patient Health Questionnaire (PHQ-9) and Short-Form 36 (SF-36), respectively. Univariate linear regression was used to identify predictors of weight change during CRP.*

Results: *We analyzed 118 patients who completed a mean of 14,92(4,32) exercise sessions. They were mostly men 108(91,5%) and had low-levels of education. Mean weight loss and mean Body Mass Index (BMI) reduction was 0,73(2,56)Kg and 0,27(0,93)Kg/m^2 respectively. Body composition showed 1,13(2,91) percent reduction in fat mass and 0,45(1,16) percent increase in lean body mass. Independent predictors of weight loss were level of education (b=0,25; p<0,001), smoking status at program entrance (quitters: b=-0,35; p<0,001; persistent smokers b=-0,27;p<0,05), depressive symptoms (b=-0,10; p=0,001; major depression: b=-1,55; p<0,001) and total energy expenditure during training session (b=0,20; p<0,05).*

Conclusion: *Weight reduction is a reflection of compliance to both dietary and physical activity recommendations in secondary prevention programs, hence its dependency on level of education, smoking status and estimated energy expenditure during physical activity. Weight change is also negatively influenced by psychological factors, mainly depression. Identifying factors associated with poorer weight response might allow earlier, individually tailored interventions such as more aggressive low-calorie high-expenditure combinations and psycho-behavioural interventions. Further studies are needed to evaluate the impact of such interventions.*

Keywords: predictors, weight change, cardiac rehabilitation.

Introduction

Overweight and its consequences are associated with increased cardiovascular morbidity and mortality.
Weight loss significantly contributes to improvement in overall cardiac risk factor profile both in primary and secondary prevention of coronary heart disease. Underlying protective mechanisms include blood pressure reduction (both in normal and hypertensive patients), lipid profile improvement, increased sensitivity to insulin and reduction of thrombotic events [1]. Since most patients enrolling phase II cardiac rehabilitation programs have excessive weight and high –levels of visceral and total body fat mass, weight reduction is usually an important target of the intervention, especially in those having a more adverse cardiac risk profile.
Anthropometric goals include a Body Mass Index (BMI) between 18,5 and 24,9 kg/m^2 and a waist circumference less than 102 cm in men and 88 cm in women [2]. The association of dietary intervention and physical exercise results in an average reduction of 4-9% in BMI [3, 4]. Exercise alone, without individualized nutritional counselling, is less effective in obtaining a substantial reduction in body weight [5, 6]. Physical exercise induces alterations in body composition [7]. A Cardiac Rehabilitation Program (CRP) consisting only of physical exercise is associated with a reduction of 0-2% of body mass at 3 months [7, 1] and a fat mass decrease of 5% along with a 2% increase in lean mass [7].
An adequate approach of overweight requires a multidimensional approach, including education and nutritional counselling, behavioural modification and physical exercise [8, 9]. Behavioural treatment strategies include stimuli control, self-monitoring, resolution of problems, social support and daily caloric intake [5].
Social factors, psychosocial status and smoking habits effectively influence adhesion to weight reduction programs (which include physical exercise and diet) [9-11,]. Identifying which factors influence weight change in coronary patients enrolled in a Phase II hospital-based multidimensional CRP will allow adoption of more effective measures and interventions to optimize clinical improvement and overall morbidity and mortality after an acute coronary event.

Methods

A prospective cohort study of 118 patients who completed a formal phase II cardiac rehabilitation program within 3 months after an acute coronary syndrome were recruited between September 2008 and December 2009. Data regarding anthropometric, clinical, laboratorial and functional response was collected at baseline and program completion. This information included electrocardiographic and laboratorial definition of the acute coronary event (unstable angina/non-ST elevation myocardial infarction/ST-elevation myocardial infarction), cardiovascular risk factor profile, angiographic extension of coronary heart disease and success of revascularization procedure and echocardiographic evidence of left ventricular function (normal vs impaired). Anthropometric data included body mass index [BMI=weight/(height)^2], waist and hip circumference measured with a flexible non-distensible measuring tape in the upright position, respectively at half-distance between costal margin and the iliac crest, and along the line connecting both trochanters. Body

composition was assessed using bio-electrical impedance (Tanita TBF 300®). Psychosocial profile and quality of life were assessed using Patient Health Questionnaire (PHQ-9) and Short-Form 36 (SF-36), respectively.

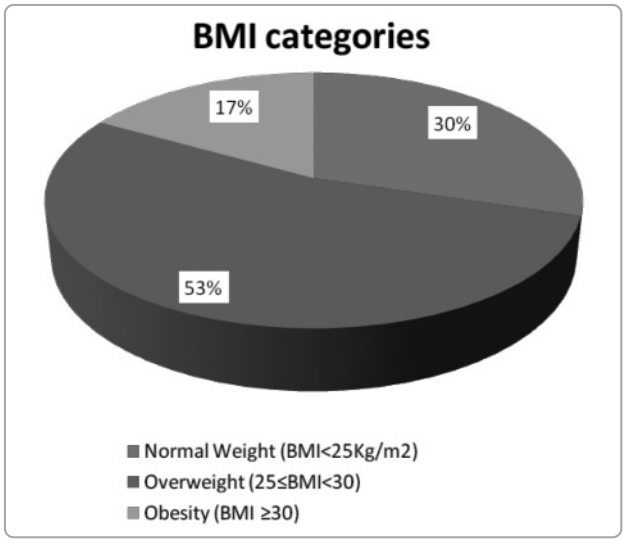
Functional capacity and energy expenditure per exercise session were estimated using the *American College of Sports Medicine* (ACSM)[12] metabolic equations for treadmill walking and were expressed as metabolic equivalents (MET) and kilocalories, respectively.

CRP included a total of 14,9 (4,4) biweekly 60-minute exercise training sessions. Each session consisted of aerobic training (40minute), with intensity set to 50-70% of heart rate reserve obtained in admission exercise stress test and to an exercise perception of 11-13 in the Borg exercise perception scale, and low-intensity high-volume strengthening exercises (40-50% 1RM, 2 sets, 10-15 repetitions). Exercise sessions also included flexibility exercises and relaxation techniques. Every patient received individual nutritional assessment and written diet plan along with instructions on risk factor management. All patients were submitted to baseline psychosocial assessment and referred to six weekly group psycho-educational sessions. Individual cognitive-behavioural intervention was offered to those having clinical depression (PHQ≥9≥10).

Variables associated with weight change were identified using Pearson-moment or Spearman rank correlation tests, according to distribution pattern of predictors. Univariate linear regression was used to identify predictors of weight change during CRP.

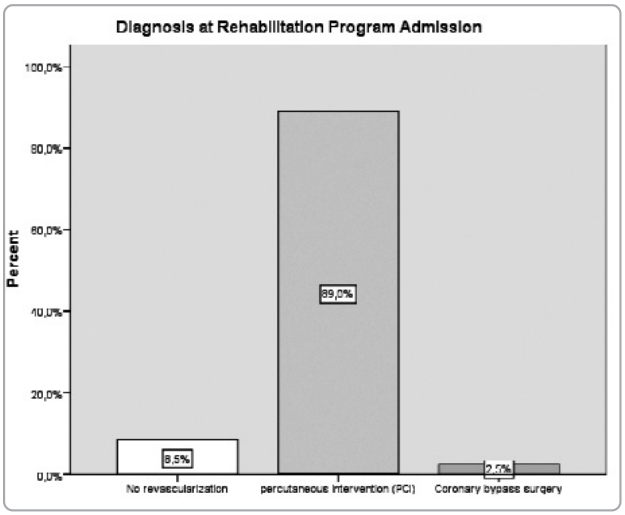
Results

The cohort consisted of 118 patients, of whom 53% were overweight, 30% had normal weight and 17% were obese – *Graphic 1*.



Graphic 1 - Weight categories at program initiation

They had had an acute coronary syndrome submitted to either percutaneous coronary intervention 106 (89,0%), coronary artery bypass surgery 3 (2,5%) or medical treatment 10 (8,5%) – *Graphic 2*.



Graphic 2 - Diagnosis at rehabilitation program admission.

Table 1 describes the patients' sociodemographic characteristics at baseline assessment and *Table 2* their risk factor profile. Acute coronary syndrome was ST-segment elevation myocardial infarction in 57 (48,3%) and most patients had preserved left ventricular systolic function(LVSF) 86 (72,6%) with only 14 (12,9%) showing moderate LVSF.

The study population completed a mean of 14,92 (4,32) exercise sessions. They were mostly men 108 (91,5%) with a mean age of 54,6 (9,6) years and a low level of education with 62 (52,5%) having studied less than 4 years.

Table 1 - Sociodemographic characteristics

	Total sample (n=118)
Sociodemographics	
Age (years), mean (SD)	54,6 (9,6)
Male gender, n (%)	108 (91,5)
Marital status-married, n (%)	105 (89,0)
Level education (years), (P50 (P25-P75))	4 (4-9)
<4 years, n(%)	62 (52,5)
Professional status, n (%)	
Active worker	71 (60,2)
Unemployed	19 (16,1)
Retired	28 (23,7)

Table 2 - Risk factor profile.

	Total sample (n=118)
Risk factor Profile	
Previous history of CHD, n (%)	19 (16,1)
Family history of CHD, n (%)	36 (30,2)
Dyslipidemia, n (%)	73 (61,9)
Hypertension, n (%)	52 (44,1)
Diabetes mellitus, n (%)	23 (19,2)
Active smokers, n (%)	69 (58,5)
Heavy smokers (>30 cig/day)	36 (30,5)

After completion of CRP, mean weight loss and mean BMI reduction was 0,73 (2,56) kg and 0,27 (0,93) kg/m^2, respectively. Body composition showed 1,13 (2,91) percent reduction in fat mass and 0,45 (1,16) percent increase in lean body mass – *Table 3*.

Independent predictors of weight loss were level of education (b=0,25; p<0,001), smoking status at program entrance with quitters (b=-0,35; p<0,001) and persistent smokers (b=-0,27;p<0,05) showing more adverse weight response to CRP. Severity of depressive symptoms negatively influenced weight reduction, as expressed by the PHQ-9 (b=-0,10; p=0,001) with major depression (PHQ-9 ≥10) having an even higher impact (b=-1,55; p<0,001). Total energy expenditure during training session maximized weight improvement (b=0,20; p<0,05). – *Table 4.*

Discussion

In coronary heart disease patients, even a relatively modest reduction in body weight may lead to substantial benefits to overall cardiac risk factor profile.

CRP are usually associated with an improvement in anthropometric markers such as BMI, abdominal obesity and fat mass body content, although effect size is frequently modest. Therefore, strategies aimed at improving weight reduction are warranted, namely identifying predictors of weight change during a hospital-based phase II cardiac rehabilitation program. In the present study, we showed that weight change is influenced by several factors, including educational

Table 3 - Anthropometric response to CRP.

Anthropometric measures variation	Baseline	Pre-post difference	*p*
Weight (Kg), median (SD)	74,28 (9,86)	-0,74 (2,57)	0,002
BMI (Kg/m^2), median (SD)	26,89 (3,49)	-0,27 (0,92)	0,002
Abdominal circumference (cm), median (SD)	95,26 (8,53)	-2,01 (3,52)	<0,001
Waist-to-hip ratio, median (SD)	0,97 (0,09)	-0,02 (0,06)	<0,001
% fat mass, median (SD)	24,27 (7,03)	-1,09 (1,95)	<0,001
%Fat free mass, median (SD)	20,07 (1,95)	0,44 (1,16)	<0,001

Table 4 - Univariate regression analysis.

Univariate linear regression analysis with weight change (pre-post difference) as dependent variable, only significant regression coefficients are expressed

	β	SE	*p*
Level of education (years)	0,13	0,05	<0,01
Smoking status			
Persistent smokers	-1,80	0,48	<0,001
Quitters	-2,09	0,70	<0,001
Depressive status (log PHQ9)	-0,62	0,34	0,05
Energy expenditure per exercise session (per 100Kcal increase)	0,53	0,25	0,04

level, psycho-behavioural characteristics such as depressive symptoms and smoking status and total energy expenditure per training session.

Weight change during CRP might be a marker of overall adherence with secondary prevention measures. Higher educated, with good coping strategies and psychological profile, tend to comply more easily and fully with life-changing recommendations such as physical activity, smoking cessation and nutrition. On the other hand, depressive symptoms impair patients' perception of the importance of risk factor control and long-term compliance with healthy behaviours; resulting in higher proportion of treatment failure, including persistent smokers, low-level energy expenditure, overweight and cardiopulmonar and muscular deconditioning.

This study has several limitations. Firstly, we did not use any specific tool (dietary diary, eating records) to assess compliance with dietary recommendations, nor did we consider or quantified the amount of physical activity performed outside the training sessions (both leisure or exercise intended). Additionally, we used anthropometric measures (waist circumference, weight, height) and bio-electrical impedance analysis of body composition to quantify weight and body fat change with the program. Although we did comply with the recommendations (international and manufacturer), some measurement bias might have been introduced.

Conclusion

Weight reduction is a reflection of adherence to both dietary and physical activity recommendations in secondary prevention programs, hence its dependency on level of education, smoking status and estimated energy expenditure during physical activity. Weight change is also negatively influenced by psychological factors, mainly depression.

Identifying factors associated with poorer weight response might allow early more individualized interventions such as more aggressive low-calorie high-expenditure combinations and psycho-behavioural interventions. Further studies are needed to evaluate the impact of such interventions.

Referências / ***References*:**

1. Lavie CJ, Milani RV, Ventura HO. Obesity and Cardiovascular Disease. J Am Coll Cardiol 2009; 53:1925–32.
2. Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). JAMA 2001; 285: 2486-97.
3. Schuler G, Hambrecht R, Schlierf G, et al. Regular physical exercise and low-fat diet: effects on progression of coronary artery disease. Circulation 1992; 86:1-11.
4. Ornish D, Brown SE, Scherwitz LW, et al. Can lifestyle changes reverse coronary heart disease? The Lifestyle Heart Trial. Lancet 1990; 336:129-33.
5. Ades PA. Cardiac rehabilitation and secondary prevention of coronary heart disease. N Engl J Med 2001; 345 (12): 892 - 902.
6. Kiat A, Cook E, Kiat H. Weight loss and fitness in patients with coronary artery disease through cardiac rehabilitation - a long-term follow-up. Heart, Lung and Circulation 2009;18.
7. Brochu M, Poehlman ET, Savage P, Fragnoli-Munn K, Ross S, Ades PA. Modest effects of exercise training alone on coronary risk factors and body composition in coronary patients. J Cardiopulm Rehabil 2000;20: 180-8.
8. Savage PD, Lee M, Harvey-Berino J, Brochu M, Ades PA. Weight reduction in the cardiac rehabilitation setting. J Cardiopulm Rehabil. 2002 May-Jun; 22(3):154-60.
9. Rabkin SW. Effect of cigarette smoking cessation on risk factors for coronary atherosclerosis: A clinical control trial. Atherosclerosis 1984; 53 (2): 173-184.
10. Dennis D. Social Support and Cardiac Rehabilitation: A Review. Journal of Cardiopulmonary Rehabilitation and Prevention 1987; 7 (4).
11. Ziegelstein RC, Fauerbach JA, Stevens SS, Romanelli J, Richter DP, Bush DE. Patients With Depression Are Less Likely to Follow Recommendations to Reduce Cardiac Risk During Recovery From a Myocardial Infarction. Arch Intern Med 2000; 160.
12. American College Sports Medicine. *Guidelines for Exercise Testing and Prescription*. Fifth ed. Philadelphia: Lea & Febiger; 1995.