Exercise Programs in Patients with Coronary Artery Disease and/or Myocardial Infarction: A Review of Systematic Reviews

7. SUPPLEMENTARY MATERIAL

Table S1. Characteristics and results of the studies included

CAD / MI			
SYSTEMATIC REVIEW AND META-ANALYSIS: Elliott AD, Rajopadhyaya K, Bentley DJ, Beltrame JF, Aromataris EC. Interval Training Versus Continuous Exercise in Patients with Coronary Artery Disease: A Meta-analysis. Heart, Lung and Circulation. 2014: 1-9. **OBJECTIVES:** to compare the effectiveness of HIIT and MICT on aerobic capacity in patients (mean age range = 55-68 years) with CAD and preserved LVEF. **METHOD:** search of studies published up to December 2013. **INCLUSION CRITERIA:** (1) RCTs comparing HIIT with MICT in patients with stable CAD in the absence of heart failure, (2) studies prescribing an exercise program for at least 4 weeks, and (3) studies including aerobic capacity as a reported outcome.			
AEROBIC CAPACITY, BLOOD LIPIDS, BLOOD PRESSURE			
HIIT			
Nº OF STUDIES	RESULTS	CONCLUSIONS	
6 (36)	HIIT was associated with improvements in VO_2peak (WMD 1.53 mL/kg^{-1}/min^{-1}; I_2= 2.69, p<0.0001) compared with MICT. HIIT programs improvement of VO_2peak was of 4.6 ± 3.1 mL/kg^{-1}/min^{-1}	Strong evidence that, compared with MICT, HIIT improved aerobic capacity in patients with stable CAD.	
FITT			
FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	Intervals: 85-95% HRpeak, 80-90% HRres, 89% PPO, 80-90% VO_2peak, 90% VO_2res Recovery: not reported	Walking (3 studies), cycling (2), arm ergometer (1), elliptical machine (1), not reported (1)	Intervals: 4-10 repetitions x 1-4 minutes Recovery: 3-10 periods x 1-3 minutes
MICT			
Nº OF STUDIES	RESULTS	CONCLUSIONS	
6 (36)	MICT was associated with improvements in VO_2peak of 2.8 ± 2.4 mL/kg^{-1}/min^{-1}	Strong evidence that MICT improved aerobic capacity.	
FITT			
FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	70% HRpeak, 60-80% HRres, 58% PPO, 50-60% VO_2peak, 65% VO_2res. Not reported (1 study)	Walking (2), cycling (2), arm ergometer (1), elliptical machine (1). Not reported (2)	30-50 minutes
OTHER CONCLUSIONS			
Limited evidence that, compared with MICT, HIIT improves blood pressure and high-density lipoproteins			
CAD / MI			
SYSTEMATIC REVIEW AND META-ANALYSIS: Gomes-Neto M, Duraes AR., Correia dos Reis HF., Neves VR., Martinez BP, Carvalho VO. High-intensity interval training versus moderate-intensity continuous training on exercise capacity and quality of life in patients with coronary artery disease: A systematic review and meta-analysis. European Journal of Preventive Cardiology. 2017; 24 (16): 1696-1707. **OBJECTIVES:** to compare the effects of HIIT and MICT on aerobic capacity and quality of life in patients (mean age range = 58-65 years) with CAD or MI. **METHOD:** search of studies published up to November 2016. **INCLUSION CRITERIA:** (1) RCTs evaluating the effects of HIIT compared with MICT; and (2) in patients with CAD (history of CAD with angina, MI or PCI).			
AEROBIC CAPACITY, QUALITY OF LIFE			
HIIT			
Nº OF STUDIES	RESULTS	CONCLUSIONS	
12 (27)	HIIT was associated with improvements in VO_2peak (MD 1.30 mL/kg/min; I_2= 60%, p=0.003) compared with MICT	Strong evidence that, compared with MICT, HIIT improved aerobic capacity in adult patients with CAD or MI.	

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	85-95% HRpeak, 80-90% HRres, 73-93% HRmax, 80-90% VO_2peak, 85-95% VO_2res. Not reported (2 studies)	Not reported	15-42 minutes

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
12	There were no significant differences on quality of life in both types of training.	Limited evidence that, compared with MICT, HIIT improved quality of life.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	63-83% HRmax, 70-80% HRpeak, 60-80% HRres, 50-60% VO_2peak, 65% VO_2res. Not reported (3 studies)	Not reported	15-50 minutes

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Hannan AL, Hing W, Climstein M, Coombes J, Jayasinghe R, Byrnes J, Furness J. High-intensity interval training versus moderate intensity continuous training within cardiac rehabilitation: a systematic review and meta-analysis. Journal of Sports Medicine. 2018; 9: 1-17.

OBJECTIVES: to compare the effects of HIIT and MICT on aerobic capacity in patients (mean age range = 52-76 years) with CAD or MI.

METHOD: search of studies published up to July 2017. **INCLUSION CRITERIA:** (1) full-text RCTs published in peer-reviewed academic journals; (2) interventions of at least 4 weeks; and (3) comparing HIIT with MICT in patients with CAD or MI.

AEROBIC CAPACITY

HIIT

Nº OF STUDIES	RESULTS	CONCLUSIONS
17 (28)	HIIT was associated with improvements in VO_2peak compared with MICT (MD 1.15 mL/kg/min; I_2=13%, p<0.00001). VO_2peak presented significant improvements in interventions between 7-12 weeks (SMD 0.43 mL/kg/min; I_2=15%, p<0.0001) and in interventions > 12 weeks (SMD 0.32 mL/kg/min; I_2=35%, p=0.01), and non-significant improvements in interventions < 6 weeks (SMD 0.19 mL/kg/min; I_2=45%, p=0.30).	Strong evidence that, compared with MICT, HIIT improved aerobic capacity in adult patients with CAD or MI. HIIT interventions between 7 and 12 weeks were associated with improvements compared with other interventions < 6 weeks and > 12 weeks.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 2-48 weeks	Interval: 85-95% HRMax, 90-95% HRpeak, 80-95% HRR, 75-104% PPO, 70-95% angina threshold, 80-95% VO_2peak Recovery: 60-70% HRmax, 50-70% HRres, 10% PPO, anaerobic threshold, 50-60% VO_2peak	Walking (2 studies), cycling (5), running (1), arm ergometer (1) elliptical machine (1). Not reported (11)	Intervals: 4-10 repetitions x 1-4 minutes Recovery: 3-10 periods x 1-3 minutes

MICT

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 2-48 weeks	70-75% HRmax, 70-80% HRpeak, 60-85% HRres, 51-65% PPO, 50-78.2% VO_2peak, 60% VO_2res, 60% angina threshold. Not reported (3 studies)	Walking (3 studies), cycling (5), running (1), arm ergometer (1) elliptical machine (1). Not reported (9)	20-50 minutes

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Hollings M, Mavros Y, Freeston J, Singh MF. The effect of progressive resistance training on aerobic fitness and strength in adults with coronary heart disease: A systematic review and meta-analysis of randomized controlled trials. European Journal of Preventive Cardiology. 2017; 24 (12): 1242-1259.

OBJECTIVES: to evaluate the effects of strength training (i.e., alone or combined with MICT) and MICT on aerobic capacity and muscular strength in adult patients (mean age = 60 ± 7 years) with CAD or MI.

METHOD: search of studies published up to July 2016. **INCLUSION CRITERIA:** (1) full length RCTs published in peer-reviewed journals, (2) adult men and women with CAD and a recent cardiac event such as MI, percutaneous coronary intervention or coronary artery bypass graft surgery, and (3) the intervention included strength training.

MUSCULAR STRENGTH, AEROBIC CAPACITY

MUSCULAR STRENGTH (ONLY)

Nº OF STUDIES	RESULTS	CONCLUSIONS
6 (37)	Strength training produced significant improvements in muscular strength (1RM) in lower limbs (SMD 0.57, I_2=20%, p=0.005) and upper limbs (SMD 1.43, I_2=53%, p<0.0001), compared with the control group. Strength training improved VO_2peak and PWC (+11.9%, I_2=86%) compared with the control group.	Strong evidence that strength training improved aerobic capacity and muscular strength in patients with CAD or MI. It is recommended to include strength training in CR to obtain higher benefits in muscular strength and functional health in adult patients with CAD or MI.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
3-4 sessions per week / 4-26 weeks	50-80% 1 RM. Not reported (3 studies)	Elastic rubber bands (1 study), machine weights (4), free weights (3), hydraulic resistance device (1)	1-4 series / 8-16 repetitions

STRENGTH TRAINING (COMBINED WITH MICT) AND MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
22	Strength training (i.e., combined with MICT) and MICT were associated with improvements in aerobic capacity (18.4% vs 15.4%) and muscular strength in the lower limbs (19.9% vs. 6.3%) and upper limbs (20.8% vs. 1.3%). Strength training (i.e., combined with MICT) improved VO_2peak (SMD 0.14, I_2=0%, p=0.06) and significantly improved PWC (SMD 0.30, I_2=5%, p=0.0009), muscular strength in the lower limbs (SMD 0.60, I_2=65%, p<0.0001) and upper limbs (SMD 0.52, I_2=0%, p<0.00001).	Strong evidence that strength training (i.e combined with MICT) and MICT improved aerobic capacity. Strong evidence that strength training (i.e combined with MICT) improved aerobic capacity and muscular strength compared with MICT.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
1-5 sessions per week / 3-26 weeks	20-80% 1 RM, 40-80% 2 RM, 11-13 RPE. Not reported (1 study)	Elastic rubber bands (1 study), machine weights (16), body weight (4), free weights (6). Not reported (3)	1-6 series / 5-20 repetitions
1-5 sessions per week / 3-26 weeks	40-85% HRmax, 11-13 RPE, 60-120% FTP, 40-70% VO_2max, 60-65% VO_2peak. Not reported (4 studies)	Badminton (1 study), calisthenics (3), walking (9 studies), cycling (13), running (3), arm ergometer (5), elliptical machine (3), rowing (1), volleyball (2). Not reported (4)	12-95 minutes

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Liou K, Ho S, Fildes J, Ooi SY. High Intensity Interval versus Moderate Intensity Continuous Training in Patients with Coronary Artery Disease: A Meta-analysis of Physiological and Clinical Parameters. Heart, Lung and Circulation. 2016; 25: 166-174.
OBJECTIVES: to compare the effects of HIIT and MICT on aerobic capacity and cardiovascular risk factors in patients (mean age range = 55-76.5years) with stable CAD.
METHOD: search of studies published up to December 2013. **INCLUSION CRITERIA:** (1) RCTs comparing HIIT with MICT in patients with stable CAD in the absence of heart failure, (2) studies prescribing an exercise program for at least 4 weeks, and (3) studies including aerobic capacity as a reported outcome.

AEROBIC CAPACITY, RESTING HEART RATE, BOSY WEIGHT

HIIT

Nº OF STUDIES	RESULTS	CONCLUSIONS
9 (39)	HIIT was associated with improvements in VO_2peak (WMD 1.78 mL/kg/min; I_2=93%, p=0.009) compared with MICT.	Strong evidence that, compared with MICT, HIIT improved aerobic capacity in adult patients with CAD or MI.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	80-95% HRpeak, 80-104% PPO, 90% VO_2res. Not reported (1 study)	Cycling (2 studies) Not reported (7)	Not reported

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
9	MICT was associated with improvements in resting HR (WMD -1.80 bpm; I_2=0%, p=0.001) and body weight (WMD -0.48 kg; I_2=0%, p=0.004) compared with HIIT.	Strong evidence that, compared with MICT, HIIT improved aerobic capacity in adult patients with CAD or MI.

HIIT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	60-90% HRpeak, 51-65% PPO, 65% VO_2res. Not reported (2 studies)	Cycling (3 studies) Not reported (5)	Not reported

CAD / MI

SYSTEMATIC REVIEW: Oliveira NL, Ribeiro F, Alves AJ, Campos L, Oliveira J. The effects of exercise training on arterial stiffness in coronary artery disease patients: a state-of-the-art review. Clinical Physiology and Functional Imaging. 2014; 34: 254-262.
OBJECTIVES: to compare the effects of exercise training on arterial stiffness in patients (mean age range = 48-67 years) with CAD or MI.
METHOD: search of studies published up to July 2012. **INCLUSION CRITERIA:** (1) prospective studies with original data (final data were compared either with control group or with baseline values); (2) published in English; (3) analyzing exercise training; and (4) in patients with CAD and arterial stiffness.

ARTERIAL STIFFNESS

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
5 (45)	The intervention improved pulse wave velocity and arterial compliance.	Limited evidence that MICT improved arterial stiffness in adult patients with CAD or MI. Further studies with appropriate methodology are necessary to reach consistent conclusions

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
1-5 sessions per week / 6-20 weeks	40-85% HRres, anaerobic threshold	Walking (2 studies), cycling (3), arm ergometer (2). Not reported (2)	15-50 minutes

CAD / MI

SYSTEMATIC REVIEW: Snoek JA, Van Berkel S, Van Meeteren N, Back FJG, Daanen HAM. Effect of Aerobic Training on Heart Rate Recovery in Patients with Established Heart Disease; a Systematic Review. PLoS ONE. 2013; 8 (12).
OBJECTIVE: to evaluate effect of MICT on heart rate recovery in patients (mean age = not reported) with CAD or MI.
METHOD: search of studies published up to July 2012. **INCLUSION CRITERIA:** (1) RCTs or quasi-randomized controlled trials in English published in peer-reviewed journals; (2) comparing MICT with control group (without exercise training); (3) duration of the therapeutic physical training being at least 2 weeks; (4) in adult patients with CAD or MI; (5) HR recovery being a dependent variable; and (6) reporting results of HR recovery pre and post intervention.

HEART RATE RECOVERY

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
7 (40)	5/7 studies reported significant improvements in HR recovery (+4-12 beats/1st minute).	Strong evidence that MICT improved HR recovery in adult patients with CAD or MI.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
3-6 sessions per week / 2-26 weeks	60-85% HRmax, anaerobic threshold, 60-70% VO_2peak	Walking (1 study), cycling (5), running (1), lunges (1), squats (1) Not reported (1)	30-80 minutes

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Valkeinen H, Aaltonen S, Kujala UM. Effects of exercise training on oxygen uptake in coronary heart disease: a systematic review and meta-analysis. Scandinavian Journal of Medicine & Science in Sports. 2010; 20 (4): 545-555.
OBJECTIVES: to determine the effect of physical training on aerobic capacity of patients (mean age = 59.9 ± 4.9 years) with CAD or MI.
METHOD: search of studies published from 1966 to March 31, 2009. **INCLUSION CRITERIA:** (1) RCTs comparing the experimental group with a non-exercise group as a control group; (2) evaluating the effects of exercise training on VO_2max in patients with CAD; (3) measuring VO_2max continuously throughout exercise test; (4) description of the exercise training intervention used (FITT); and (5) reporting the results of VO_2max.

AEROBIC CAPACITY

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
14 (41)	MICT was associated with significant improvements in VO_2max (MD 2.3 mL/kg/min; SMD 0.61, I_2=72%, p<0.001).	Strong evidence that MICT improved aerobic capacity in patients with CAD or MI.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
1-6 sessions per week / 5-48 weeks	70-85% HRmax, anaerobic threshold, 70% VO_2max, 25-70% VO_2peak	Calisthenics (3 studies), walking (6), cycling (12), running (2), arm ergometer (1), rowing (1)	20-60 minutes

STRENGTH TRAINING (i.e., ALONE or COMBINED with MICT)

Nº OF STUDIES	RESULTS	CONCLUSIONS
3	Strength training (only or combined with MICT) produced non-significant improvements in VO_2max (SMD 0.20 mL/kg/min; I_2=0%, p=0.39).	Limited evidence that strength training (alone or combined with MICT) improved aerobic capacity in adult patients with CAD or MI.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
3 sessions / 10-24 weeks	40-60% MCV, 50-80% 1 RM	Weight training (1 study) Not reported (1)	45 minutes
2 sessions per week / 32 weeks	60-75% HRmax 60% 1 RM (initially)	Walking, cycling, running Weight training	60 minutes Not reported

OTHER CONCLUSIONS

Improvements in VO_2max were greater when the duration of MICT was 6 to 12 months (SMD 0.94 mL/kg/min; I_2=85%, p<0.001) compared with exercise training with a duration < 6 months (SMD 0.41 mL/kg/min; I_2=14%, p<0.001). MICT starting within the first 3 months (SMD 0.77 mL/kg/min; I_2=74%, p<0.001) after a cardiac event (percutaneous transluminal coronary angioplasty, myocardial revascularization surgery, MI, percutaneous coronary intervention) produced greater improvements compared with exercise training starting 3 months after (SMD 0.28 mL/kg/min; I_2=21%, p=0.06) the cardiac event.

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Yamamoto S, Hotta K, Ota E, Mori R, Matsunaga A. Effects of resistance training on muscle strength, exercise capacity, and mobility in middle-aged and elderly patients with coronary artery disease: A meta-analysis. Journal of Cardiology. 2016; (68): 125-134.
OBJECTIVES: to clarify the effects of strength training on exercise capacity, skeletal muscular strength, and mobility in adult patients (49-65 years) and elderly adults (49-65 years) with CAD.
METHOD: search of studies published up to January 2014. **INCLUSION CRITERIA:** (1) RCTs comparing strength training with control group (without exercise training) or MICT; (2) male and female participants of any age; (3) MI or CAD (coronary artery revascularization: coronary artery bypass grafting, percutaneous transluminal coronary angioplasty, or coronary artery stenting).

AEROBIC CAPACITY, MOBILITY, MUSCULAR STRENGTH

STRENGTH TRAINING

Nº OF STUDIES	RESULTS	CONCLUSIONS
15 (42)	Strength training was associated with significant improvements in muscular strength in upper limbs (SMD 0.82, I_2=0%, p<0.00001) and lower limbs (SMD 0.63, I_2=54%, p<0.00001), on VO_2peak (SMD 0.82 mL/kg/min; I_2=0%, p<0.0008) and in exercise stress test duration (SMD 0.48, I_2=47%, p<0.0001) in adult patients and elderly patients compared with the control group. The intervention was associated with significant improvements in functional mobility (household physical activity and functional mobility scores in tests) in elderly adults (SMD 0.61, I_2=12%, p=0.003) compared with the control group.	Strong evidence that strength training iimproved aerobic capacity and muscular strength in adult patients (< 65 years) and elderly adults (> 65 years) with CAD or MI. Strong evidence that strength training improved functional mobility in elderly adults with CAD or MI

FITT

ADULTS (< 65 YEARS)

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-3 sessions per week / 6-29 weeks	40-60% MCV, 20-80% 1 RM. Not reported (1 study)	Elastic rubber bands (1 study), body weight (1), weight training (12)	Not reported

ELDERLY PATIENTS (> 65 YEARS)

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
3-5 sessions per week / 2-24 weeks	50-80% 1 RM	Weight training (3)	Not reported

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Yang Y, Wang Y, Wang S, Shi P, Wang C. The effect of Tai Chi on Cardiorespiratory Fitness for Coronary Disease Rehabilitation: A Systematic Review and Meta-Analysis. Frontiers in Physiology. 2018; 8 (1091).

OBJECTIVES: to evaluate the effect of Tai Chi on aerobic capacity in patients (mean age range= 55.7-68.7 years) with CAD or MI.

METHOD: search of studies published up to April 2017. **INCLUSION CRITERIA:** (1) clinical studies (RCTs, non-RCTs, cohort studies and case-control studies) with treatment for more than1 month; (2) participants with clear diagnosis of coronary artery disease without any restrictions during the period of the intervention; (3) clear descriptions about Tai Chi (style teaching and practicing process and practice frequency); (4) comparing Tai Chi practice with other exercise training or control group; and(5) reporting aerobic capacity assessed by VO_2max which was tested by cardiopulmonary exercise test.

AEROBIC CAPACITY, PEAK HEART RATE

TAI CHI TRAINING

Nº OF STUDIES	RESULTS	CONCLUSIONS
5 (34)	In three studies, Tai Chi was associated with improvements in VO_2peak ((SMD 4.71 mL/kg/min; I_2=0%, p<0.00001) compared with low or moderate intensity training. Two studies reported improvements in HRpeak compared with the control group (SMD: 13.68, I_2=28%, p=0.00001) and with other types of low or moderate intensity training (SMD 3.78, I_2=0%, p=0.37).	Limited evidence that Tai Chi training improvedaerobic capacity and HRpeak in patients with CAD or MI; this intervention could be possibly considered for CR. Further studies with appropriate methodology are necessary to confirm these results.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
3-7 sessions per week / 24-48 weeks	Not reported	Beijing style (1 study), Yang style (3). Not reported (1)	30-60 minutes

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Liu T, Chan AWK, Liu YH, Taylor-Piliae RE. Effects of Tai Chi-based cardiac rehabilitation on aerobic endurance, psychosocial well-being, and cardiovascular risk reduction among patients with coronary heart disease: A systematic review and meta-analysis. European Journal of Cardiovascular Nursing. 2018; 17 (4) 368-383.

OBJECTIVES: to evaluate the effect of Tai Chi on quality of life, aerobic capacity and cardiovascular risk factors in patients (mean age= 64 years) with CAD or MI.

METHOD: search of studies published up to January 2017. **INCLUSION CRITERIA:** (1) RCTs or non-randomized clinical controlled trials; (2) in patients with CAD (MI, angina, PCI or coronary artery bypass grafting); (3) studies that used Tai Chi as an intervention (Tai Chi only or Tai Chi with other interventions); and (4) with reports of results on aerobic endurance, psychosocial well-being or cardiovascular risk factors.

AEROBIC CAPACITY, PEAK HEART RATE

TAI CHI TRAINING

Nº OF STUDIES	RESULTS	CONCLUSIONS
13 (31)	Tai Chi training was associated with significant improvements in exercise test duration (SMD 1.12, I_2=83%, p<0.0001) and VO_2max (SMD 4.8 mL/kg/min; I_2=83%, p<0.00001). Two studies reported significant improvements in anxiety (-9.28 I_2=83%, p=0.03) and depression (MDS -9.42, I_2=81%, p<0.00001), and 4 studies on quality of life (MDS 0.73, I_2=56%, p<0.0001) compared with the control group. There were no significant improvements in blood pressure and blood lipids.	Strong evidence that Tai Chi improved aerobic capacity in adult patients with CAD or MI. Moderate evidence of benefits of Tai Chi on anxiety, quality of life and depression and limited evidence on blood pressure and blood lipids. Further studies with appropriate methodology analyzing different Tai Chi training protocols and their effects on these variables are necessary.

FITT			
FREQUENCY/DURATION	INTENSITY	TYPE	TIME
1-5 sessions per week / 12-48 weeks	48-57% HRmax, < HRmax (220 - age), 40-60% VO_2max. Not reported (9 studies)	Chen style (2 studies), Sun style (1), Yang style (5) Not reported (6)	10-90 minutes

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Cramer H, Lauche R, Haller H, Dobos G, Michalsen A. A systematic review of yoga for heart disease. European Journal of Preventive Cardiology. 2015; 22 (3): 284-295.

OBJECTIVES: to evaluate the quality of the effects of yoga on variables of CR in patients (mean age range= 51.5-58.75 years) with CAD.

METHOD: search of studies published up to October 2013. **INCLUSION CRITERIA:** (1) RCTs, cluster-randomized trials or randomized cross-over studies; (2) adult participants with CAD or cardiomyopathy or heart failure or cardiac arrhythmia, or valvular heart disease; (3) studies that compared the intervention yoga with usual care of CR; and (4) with reports of at least one of the following main outcome measures: mortality (all-cause mortality or cardiac mortality), nonfatal cardiac events (MI, arrhythmias, angina, stroke), or exercise capacity, or quality of life or modifiable cardiac risk factors (blood pressure, blood lipid levels).

AEROBIC CAPACITY, ADVERSE CARDIAC EVENTS, ALL-CAUSE MORTALITY, BLOOD LIPIDS, BLOOD PRESSURE

YOGA TRAINING

Nº OF STUDIES	RESULTS	CONCLUSIONS
4 (35)	There were no adverse cardiac events in one study; in another study the intervention was associated with improvements in test duration, 3 studies reported improvements in blood lipid levels and 2 studies reported improvements in blood pressure. Of the 3 studies that reported data on mortality, 3 deaths were reported in the yoga group and 3 in the control group.	Limited evidence of the effects of yoga on aerobic capacity, adverse cardiac events, mortality, lipid levels, and blood pressure in adult patients with CAD. Limited recommendation for the use of yoga in secondary prevention in adult patients with CAD. Further studies with appropriate methodology analyzing the effects of yoga training on these variables are necessary.

FITT			
FREQUENCY/DURATION	INTENSITY	TYPE	TIME
4-5 sessions per week / 14-72 weeks	Not reported	The style is not reported (meditation, postures, relaxation and breathing)	35-40 minutes

CAD

SYSTEMATIC REVIEW AND META-ANALYSIS: Karagiannis C, Savva C, Mamais I, Efstathiou M, Monticone M, Xanthos T. Eccentric exercise in ischemic cardiac patients and functional capacity: A systematic review and meta-analysis of randomized controlled trials. Annals of Physical and Rehabilitation Medicine. 2016.

OBJECTIVES: to analyze the efficacy of eccentric training on aerobic capacity in patients (mean age = 57 ± 8 years) with CAD.

METHOD: search of studies published up to July 2016. **INCLUSION CRITERIA:** (1) men and women > 18 years with dignosis of CAD or MI or heart failure; ((2) any form of eccentric exercise training program; 3) comparing no exercise or other types of exercise programs; (4) functional capacity assessed by maximal or submaximal tests; and (5) RCTs.

AEROBIC CAPACITY

ECCENTRIC TRAINING

Nº OF STUDIES	RESULTS	CONCLUSIONS
2 (38)	Three studies reported non-significant improvements in test duration (SMD -2.92, I_2=0%, p=0.84) and 2 studies on VO_2peak (MD 0.52 mL/kg/min, I_2=0%, p=0.54).	Limited evidence of the effectiveness of eccentric training on aerobic capacity of adult patients with CAD,

FITT			
FREQUENCY/DURATION	INTENSITY	TYPE	TIME
3 sessions per week / 5-8 weeks	85% HRmax, ventilatory threshold 20 rpm, 60% VO_2max	Eccentric ergometer (2 studies)	30 minutes

CAD / MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Kraal JJ, Vromen T, Spee R, Kemps HMC, Peek N. The influence of training characteristics on the effect of exercise training in patients with coronary artery disease: Systematic review and meta-regression analysis. International Journal of Cardiology. 2017; 245.
OBJECTIVES: to evaluate the effects of the training characteristics (frequency, intensity, type, time) and total energy expenditure on aerobic capacity in patients (mean age = 58.8 years) with CAD.
METHOD: search of studies published from April 2017 to April 2015. **INCLUSION CRITERIA:** (1) full-text RCTs published in English; (2) comparing MICT with usual care (without exercise training) in patients with CAD; (3) reporting frequency, intensity and duration of the intervention; and (4) reporting changes in VO_2peak to evaluate training effects.

AEROBIC CAPACITY

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
8 (30)	MICT produced significant improvements in VO_2peak (MD 3.97 mL/kg^{-1}/min^{-1}, I_2=73%, p<0.01). Maximum improvements of 0.49 mL/kg^{-1}/min^{-1} VO_2peak were achieved by an increase in session frequency from 2 to 5 sessions per week and of 5. mL/kg^{-1}/min^{-1} by increasing program length from 2 to 28 weeks. Maximum improvements of 1.68 mL/kg^{-1}/min^{-1} were achieved by increasing intensity (45 to 79% of VO_2peak) and of 2.57 mL/kg^{-1}/min^{-1} by increasing session duration (20 to 45 minutes). These effects were absent after correction for total energy expenditure.	Strong evidence that MICT improved aerobic capacity in adult patients with CAD. Total energy expenditure is the main determinant in improving exercise capacity in adult patients with CAD. Any component of the FITT principle is adequate to increase total energy expenditure.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 2-28 weeks	44.5-78.9% VO_2peak	Not reported	20-45 minutes

OTHER CONCLUSIONS

One session per week was associated with improvements of 0.21 mL/kg^{-1}/min^{-1} VO_2peak (I_2=90.8%, p=0.019). A program length of 2 weeks was associated with improvements of 0.49 mL/kg^{-1}/min^{-1} VO_2peak (I_2=75.9%, p<0. 001). A training intensity of 10% VO_2peak was associated with improvements of 0.61 mL/kg^{-1}/min^{-1} VO_2peak (I_2=73.7%, p<0.001). A session duration of 10 minutes was associated with improvements of 1.25 mL/kg^{-1}/min^{-1} VO_2peak (I_2=69.6%, p<0.001).

CAD

SYSTEMATIC REVIEW AND META-ANALYSIS: Long L, Anderson L, Dewhirst AM, He J, Bridges C, Gandhi M, Taylor RS. Exercise-based cardiac rehabilitation for adults with stable angina. Cochrane Database of Systematic Reviews. 2018; (2).
OBJECTIVES: to assess the effects of exercise-based CR compared to usual care for adults (mean age range = 50-66 years) with CAD.
METHOD: search of studies published up to November 2016. RCTs with a follow-up period of at least six months, which compared exercise training with usual care (without exercise training) in different variables of CR were included. Adult patients of both sexes > 18 years with stable angina were included. The studies selected evaluated exercise-based CR interventions either alone or with other components (education or psychosocial support).

AEROBIC CAPACITY, QUALITY OF LIFE, COSTS, ADVERSE CARDIAC EVENTS, ALL-CAUSE MORTALITY

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
5 (32)	Five low-quality studies reported significant improvements in VO_2max and test duration (SMD 0.45, I^2=16%, p=0.0003). MICT was associated with non-significant improvements in quality of life, healthcare costs and myocardial infarction in very low-quality studies. There were no improvements in mortality.	Limited evidence of improvements in quality of life, aerobic capacity, economic cost, adverse cardiac events, and all-cause mortality in patients with CAD and stable angina with MICT.

FITT			
FREQUENCY/DURATION	INTENSITY	TYPE	TIME
Daily sessions per week / 12-48 weeks	70-75% HRmax Not reported (3 studies)	Calisthenics (1 study), walking (61, cycling (2), yoga (1).	11-90 minutes

CAD

SYSTEMATIC REVIEW AND META-ANALYSIS: Pattyn N, Coeckelberghs E, Buys R, Cornelissen VA, Vanhees L. Aerobic Interval Training vs. Moderate Continuous Training in Coronary Artery Disease Patients: A Systematic Review and Meta-Analysis. Sports Medicine. 2014.

OBJECTIVES: to summarize the effects of HIT compared with MICT on aerobic capacity, submaximal exercise capacity, and body weight in patients (mean age = 62.5 years) with CAD with preserved or reduced left ventricular LVEF.

METHOD: search of studies published up to May 2013. **INCLUSION CRITERIA:** (1) randomized intervention studies, (2) comparing supervised HIIT with supervised MCT, (3) with a duration of at least 4 weeks, (4) in CAD patients with preserved and/or reduced LVEF, (5) reporting pre- and post-intervention mean and standard deviations (SDs) (or standard errors) or mean change and SDs (or standard errors) of VO_2peak, and (6) published in a peer-reviewed journal up to May 2013.

AEROBIC CAPACITY, VENTILATORY EFFICIENCY SLOPE, BODY WEIGHT, FIRST VENTILATORY THRESHOLD

HIIT

Nº OF STUDIES	RESULTS	CONCLUSIONS
5 (44)	HIIT was associated with significant improvements in VO_2peak MD 1.60 mL/kg/min; I_2=83%, p=0.03) compared with MICT. Improvements in VO_2peak values of 4.26 ± 2.47 mL/kg/min were achieved with HIIT programs	Strong evidence that, compared with MICT, HIIT improved aerobic capacity in adult patients with CAD.

FITT			
FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	Interval: 85-95% HRpeak, 90% HRres / VO_2res, respiratory compensatory point, 80-90% VO_2max, 100-120% WRm Recovery: 70% HRmax, 40% HRres / VO_2res, anaerobic threshold, 50-60% VO_2peak, 10% WRm	Walking (1 study), cycling (2), arm ergometer (1) elliptical machine (1). Not reported (2)	Intervals: 4-10 repetitions x 1-4 min Recovery: 3-10 periods x 1-3 min

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
5	MICT was associated with improvements in VO_2peak (2.61 ± 2.12 mL/kg/min). MICT was associated with significant improvements in body weight (MD: 0.78 kg, I_2=0%, p=0.05) compared with HIIT.	Strong evidence that MICT improved aerobic capacity in this population. Strong evidence that MICT improved body weight compared with HIIT.

FITT			
FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-12 weeks	70% HRmax, anaerobic threshold, 50-60% VO_2max, 58% WRm	Walking (1 study), cycling (2), arm ergometer (1) elliptical machine (1). Not reported (2)	30-50 minutes

OTHER CONCLUSIONS

There were no differences in ventilatory efficiency slope and first ventilatory threshold.

CAD

SYSTEMATIC REVIEW AND META-ANALYSIS: Pattyn N, Beulque R, Cornelissen V. Aerobic Interval vs. Continuous Training in Patients with Coronary Artery Disease or Heart Failure: An Updated Systematic Review and Meta-Analysis with a Focus on Secondary Outcomes. Sports Medicine. 2018.

OBJECTIVES: to update the original systematic review and meta-analysis focusing on peak oxygen uptake and evaluate the effect on secondary outcomes in adult patients (mean age = 60.7 ± 10.7 years) with CAD or heart failure.

METHOD: search of studies published up to March 2017. **INCLUSION CRITERIA:** (1) RCTs comparing the effects of HIIT with MICT (2) with a duration of at least 4 weeks, (3) in patients with CAD or heart failure, (4) reporting pre- and post-intervention mean (or mean change) and standard deviations (or standard errors) of VO_2peak and secondary outcomes: cardiorespiratory parameters, cardiovascular risk factors, cardiac function, vascular function or quality of life, and (4) published in English in peer-reviewed journals up to March 2017.

QUALITY OF LIFE, AEROBIC CAPACITY, FLOW-MEDIATED DILATION, RESTING HR, PEAK HR, HR RECOVERY, LVEF, BLOOD LIPIDS, BLOOD GLUCOSE, FIRST VENTILATORY THRESHOLD, OXYGEN UPTAKE EFFICIENCY SLOPE, VENTILATORY EFFICIENCY SLOPE, BODY WEIGHT, BLOOD PRESSURE, OXYGEN PULSE.

HIIT

Nº OF STUDIES	RESULTS	CONCLUSIONS
11 (33)	HIIT was associated with significant improvements in VO_2peak (MD 1.25 mL/kg/min; I_2=0%, p=0.001) compared with MICT. HIIT was associated with significant improvements in HRpeak (MD 5.11 latidos/min, I_2=0%, p=0.002) compared with MICT.	Strong evidence that, compared with MICT, HIIT improved aerobic capacity and HRpeak in adult patients with CAD.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	Intervals: 85-95% HRpeak, 80-95% HRres, 89-110%% PPO, 50% PWC, 80-90% VO_2peak Recovery: 50-70% HRpeak, 35-70% HRres, 10% PPO, 10% PWC, 50-60% VO_2peak	Walking/running (8 studies), cycling (3), arm ergometer (1) elliptical machine (1).Not reported (2)	Intervals: 4-15 repetitions x 0.5-4 minutes Recovery: 4-15 periods x 0.5-3 minutes

MICT

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 4-16 weeks	60-75% HRpeak, 50-80% HRres, 51-65% PPO, first ventilatory threshold, 50-60% VO_2peak	Walking/running (8 studies), cycling (3), arm ergometer (1) elliptical machine (1).	40-60 minutes

OTHER CONCLUSIONS

HIIT was associated with non-significant improvements in oxygen uptake efficiency slope, ventilatory efficiency slope, first ventilatory threshold and oxygen pulse compared with MICT. MICT was associated with non-significant improvements in blood glucose, blood lipids and LVEF compared with HIIT. There were no significant differences between HIIT and MICT for the rest of the outcomes.

Very HIIT protocols (>90% HRpeak; >85% HRres; >80% VO_2peak) were associated with improvements in VO_2 peak compared with HIIT protocols (<89% HR peak; <84% HRres; <79% VO_2peak) but there were no significant differences (p = 0.55) between the subgroups. There were no significant differences (p = 0.71) on VO_2 peak in the different interval lengths (<1 min; 1-3min; >4 min) of HIIT. There were no significant differences (p = 0171) in VO_2 peak in the different types of exercise (walking/running vs. cycling) using HIIT. There were no significant differences (p = 0.73) in VO_2 peak in the different durations (<12 weeks vs. >12 weeks) of HIIT.

CAD

SYSTEMATIC REVIEW AND META-ANALYSIS: Haykowsky M, Scott J, Esch B, Schopflocher D, Myers J, Paterson I, Warburton D, Jones L, Clark AM. A Meta-analysis of the effects of Exercise Training on Left Ventricular Remodeling Following Myocardial Infarction: Start early and go longer for greatest exercise benefits on remodeling. Trails. 2011; 12 (1): 92.

OBJECTIVES: to assess the effects of exercise training on left ventricular remodeling (LVEF, end-diastolic and end-systolic volumes) in clinically stable post-MI patients (mean age = 55 years).

METHOD: search of studies published up to July 2016. **INCLUSION CRITERIA:** (1) randomized trials, (2) published in English, (3) reporting the effects of any form of MICT, and (4) comparing with a control group (without exercise intervention) LVEF, end-systolic and end-diastolic volumes in post-MI patients.

LEFT VENTRICULAR EJECTION FRACTION, END-SYSTOLIC AND END-DIASTOLIC VOLUMES

MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
11 (29)	LVEF and end-diastolic/end-systolic volumes significantly improved ($p < 0.05$) with MICT programs starting early (between 1 and 7 weeks) and with longer duration (between 1 and 6 months).	Moderate evidence that MICT improved LVEF and ventricular volumes in clinically stable post-MI patients. The greatest benefit occurred when MICT started within the first week of the cardiac event and lasted 6 months.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
3-7 sessions per week / 4-24 weeks	70-82% HRpeak, 60-70% HRres, 60-70% VO_2peak. Not reported (2 studies)	Calisthenics (1 study), walking (7), cycling (10), running (3), swimming (1).	30-80 minutes

MI

SYSTEMATIC REVIEW AND META-ANALYSIS: Lawler PR, Filion KB, Eisenberg MJ. Efficacy of exercise-based cardiac rehabilitation post-myocardial infarction: A systematic review and meta-analysis of randomized controlled trials. American Heart Journal. 2011; 162 (4): 571-584.

OBJECTIVES: to estimate the effects of exercise training on cardiovascular outcomes in patients (mean age = 54.7 years) with MI.

METHOD: search of studies published up to June 2010. **INCLUSION CRITERIA:** (1) RCTs published in English-language peer-reviewed journal; (2) patients who recently survived a MI; (3) evaluating the efficacy of exercise-based CR compared with a control group (without exercise training); (4) a minimum intervention duration of 2 weeks; and (5) a minimum follow-up of 12 weeks.

ALL-CAUSE MORTALITY, CARDIAC MORTALITY, CARDIOVASCULAR MORTALITY, REINFARCTION

HIIT and MICT

Nº OF STUDIES	RESULTS	CONCLUSIONS
21 (43)	Exercise-based CR (HIIT and MICT) was associated with improvements in cardiac mortality (OR 0.64, I_2=0%, p=0.96), cardiovascular mortality (OR 0.61, I_2=0%, p=0.9), all-cause mortality (OR 0.74, I_2=0%, p=0.97), and reinfarction (OR 0.53, I_2=0%, p=0.92). Exercise training with duration > 3 months and < 3 months was associated with improvements.	Moderate evidence that exercise training improved cardiac mortality, cardiovascular mortality, all-cause mortality and reinfarction. Moderate evidence that exercise training duration > 3 months or < 3 months improved these variables.

FITT

FREQUENCY/DURATION	INTENSITY	TYPE	TIME
2-5 sessions per week / 2-48 weeks	HIIT: 70-90% HRpeak, 55-70% VO_2peak. Not reported (1 study)	Calisthenics (4 studies), walking (5), running (2).	20-45 minutes
	MICT: 70-85% HRmax, 65-85% HRpeak, 60% VO_2peak, 75% WRm. Not reported (5)	Walking (3), cycling (8), running (1), arm ergometer (1). Not reported (4)	30-60 minutes

CAD: coronary artery disease; HR: hear rate; HRmax: maximum heart rate; HRres: heart rate reserve; HRpeak: peak heart rate; LVEF: left ventricular ejection fraction; HIIT: high intensity interval training; I_2: heterogeneity; PCI: percutaneous coronary intervention; MI: myocardial infarction; LDL: low-density lipoprotein; MICT: moderate intensity continuous training; MVC: maximum voluntary contraction; OR: odds ratio; PPO: peak power output: PWC: peak work capacity; CR: cardiac rehabilitation; RCT: randomized controlled trial; RM: repetition maximum; RPE: rate of perceived exertion; SMD: standardized mean difference; FTP: functional threshold power; VO_2: oxygen uptake;VO_2max: maximum oxygen uptake; VO_2peak: peak oxygen uptake; VO_2res: oxygen uptake reserve; WMD: weighted mean difference; WRm: maximum workload.

Table S2. Studies by variables analyzed

	Cramer 2015	Elliott 2014	Gomes-Neto 2017	Hannan 2018	Haykowsky 2011	Hollings 2017	Karagiannis 2016	Kraal 2011	Lawler 2011	Liou 2016	Liu 2018	Long 2018	Oliveira 2014	Pattyn 2014	Pattyn 2018	Snoek 2013	Valkeinen 2010	Yamamoto 2016	Yang 2018
Anxiety											+								
Quality of life			+								+	+			+				
Aerobic capacity	+	+	+	+		+	+	+		+	+	+		+	+		+	+	+
Costs											+	+							
Depression																			
Flow-mediated dilation															+				
Adverse cardiac events	+			+								+							
LVEF					+										+				
HR recovery															+	+			
Resting HR										+					+				
Peak HR															+				+
Muscular strength						+												+	
Mortality	+								+			+							
Mobility																		+	
Glucose level															+				
Lipid level	+	+									+				+				
Oxygen uptake efficiency slope	+														+				
Ventilatory efficiency slope														+	+				
Body weight										+				+	+				
Blood pressure	+	+									+				+				
First ventilatory threshold														+	+				
O2 pulse															+				
Reinfarction									+										
Arterial stiffness													+						
Ventricular volume					+														

Table S3. Studies by type of exercise training included

	Cramer 2015	Elliott 2014	Gomes-Neto 2017	Hannan 2018	Haykowsky 2011	Hollings 2017	Karagiannis 2016	Kraal 2011	Lawler 2011	Liou 2016	Liu 2018	Long 2018	Oliveira 2014	Pattyn 2014	Pattyn 2018	Snoek 2013	Valkeinen 2010	Yamamoto 2016	Yang 2018
Eccentric training Strength							+											+	
HIIT / MICT		+	+	+					+	+				+	+				
MICT					+			+				+	+			+			
MICT / Strength						+											+		
Tai Chi											+								+
Yoga	+																		

Table S4. Studies according to the influence of the components of the FITT principle on CR variables

	Cramer 2015	Elliott 2014	Gomes-Neto 2017	Hannan 2018	Haykowsky 2011	Hollings 2017	Karagiannis 2016	Kraal 2011	Lawler 2011	Liou 2016	Liu 2018	Long 2018	Oliveira 2014	Pattyn 2014	Pattyn 2018	Snoek 2013	Valkeinen 2010	Yamamoto 2016	Yang 2018
Frequency								+											
Duration				+	+			+	+						+		+		
Intensity								+							+				
Type															+				
Time								+							+				
Beginning of exercise training					+												+		