Het Falende Hart in Beweging

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CNE Hartfalen en Hartrevalidatie
Nederlandse Vereniging voor Hart en Vaat Verpleegkundigen

Dinsdag 21 april 2015

Inhoud

* Pathofysiologie
* Fysieke Training
* Inspanningsdiagnostiek

Quiz

Vraag	Score	Antwoord	Verschil (abs)
1			
2			
3			
4			
5			
6a			
6b			
som			

Vraag 1

* Hoeveel procent van de patiënten met chronisch hartfalen is in Nederland vijf jaar na diagnose overleden?

Vraag 2

* Hoeveel procent van de patiënten met chronisch hartfalen die een indicatie hebben voor hartrevalidatie krijgt dit in Nederland daadwerkelijk aangeboden?

Vraag 3

* Hoeveel procent van de patiënten met chronisch hartfalen verbeteren hun peak VO_2 (>109%) door fysieke training?

Vraag 4

* Hoeveel procent van de patiënten met chronisch hartfalen valt gemiddeld uit tijdens een fysiek trainingsprogramma van 12 weken?

Vraag 5

* Hoeveel hartslagen (/min) moet men bij inspanning verwijderd blijven van de VT-zone van de ICD van een CHF patiënt?

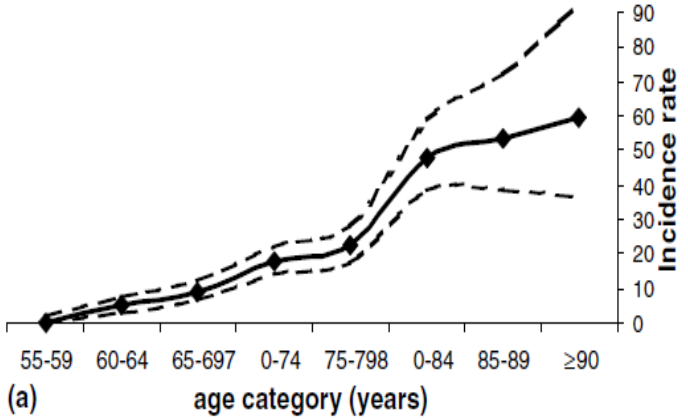
Vraag 6

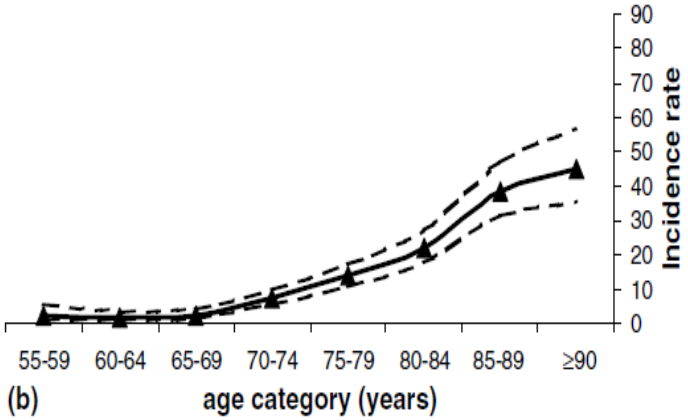
* Vanaf welke waarde voor peak VO_2
  * wordt een CHF patient geschikt geacht voor hartrevalidatie? (goed genoeg)
  * wordt een CHF patient geschikt geacht voor harttransplantatie? (slecht genoeg)

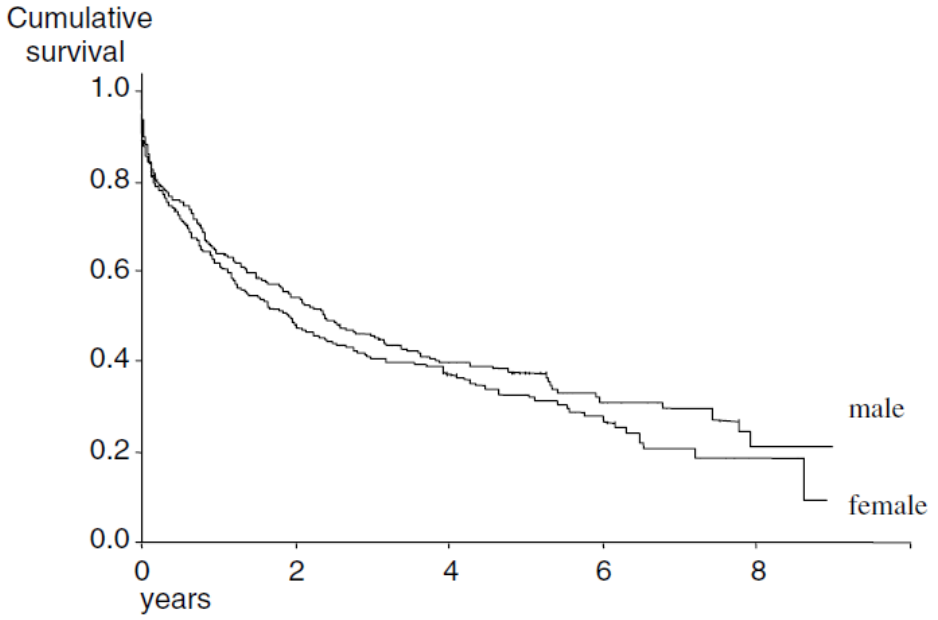
Het Falende Hart in Beweging

Epidemiologie

Epidemiologie







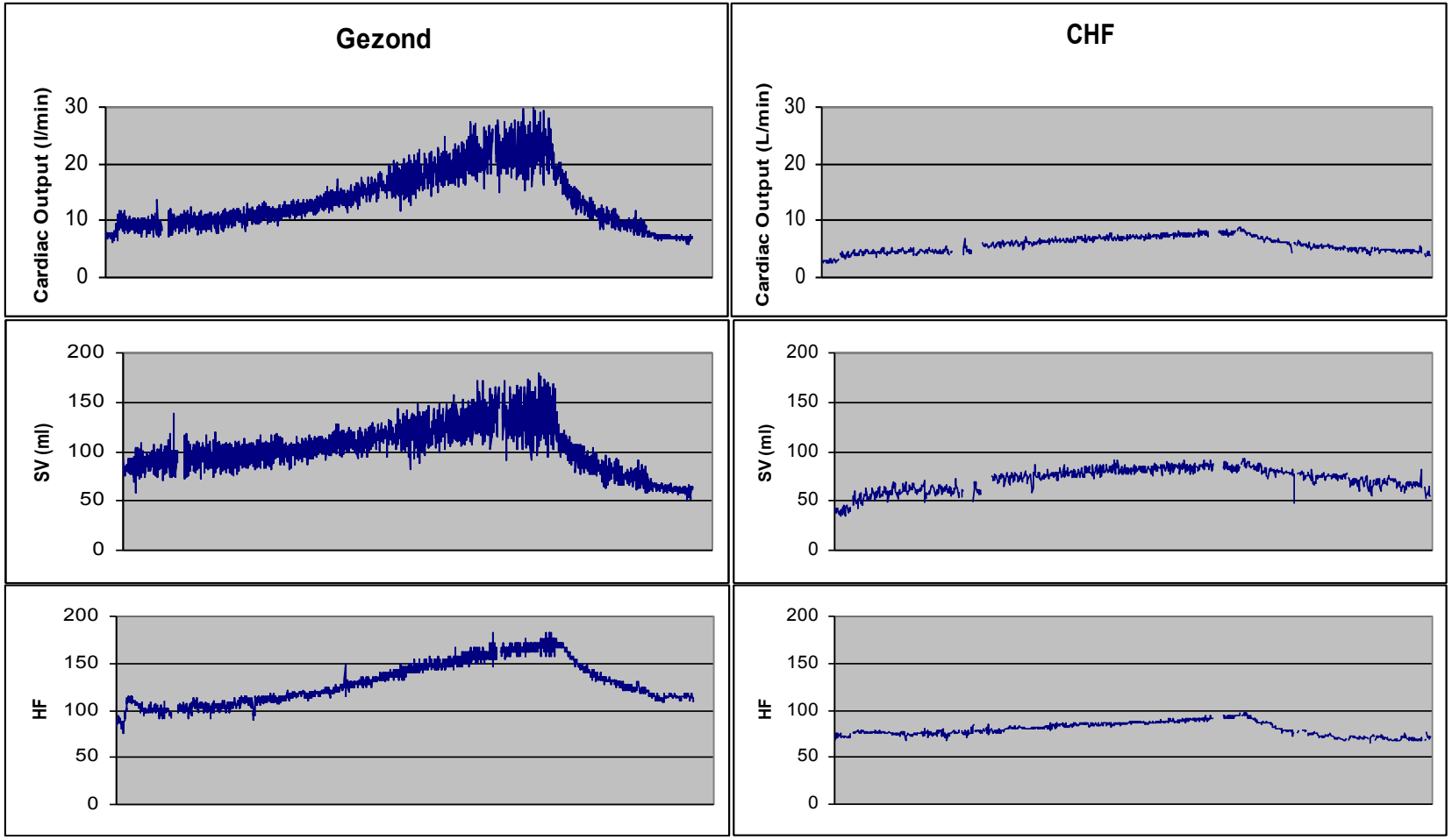
Het Falende Hart in Beweging

Pathofysiologie

Pathofysiologie CHF

* *"A pathophysiological state in which an abnormality of cardiac function is responsible for the failure of the heart to pump blood at a rate commensurate with the requirements of the metabolising tissues" (Braunwald, 1980)*

* Etiologie
  * Ischemische cardiomyopathie
  * Dilaterende cardiomyopathie
  * Hypertensieve cardiomyopathie
  * Valvulaire cardiomyopathie

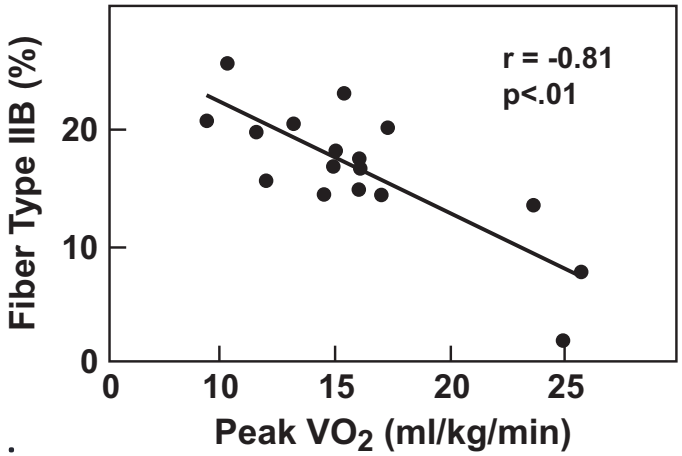

Gezond
CHF
Cardiac Output (l/min)
Cardiac Output (L/min)
SV (ml)
HF
0
10
20
30
50
100
150
200

Pathofysiologie CHF

* Centraal
  * *Afgenomen cardiac output (CO = SV X HR)*
  * *Afgenomen LVEF (dilatatie)*
  * *Coronair perfusie*
  * *Sympathetic nerve activity (SNA)*
  * *Systemische inflammatie*

Pathofysiologie CHF

* Perifeer
  * *Perifere vasoconstrictie (neurohormonaal)*
  * *Skeletspieratrofie*
    * Shift vezeltype (I ⟶ $II_{a/b}$)
  * *Calciummetabolisme*
  * *Capillairen*
    * verminderde RBC flux
  * *Competitieve bloedstromen*
    * Ademhalingspieren vs locomotor spieren



Pathofysiologie CHF

* Coordinated adaptation

		Pulmonary Diffusion	Cardiovascular Delivery	Muscle Extraction	Oxidative Phosphorylation
Olympic athlete	Capacity $\frac{\Delta \text{ flux}}{\Delta \text{ capacity}}$	+	+	+	+
Untrained person		0	++	++	++
Chronic Lung Disease		+	+	+	+
Chronic Heart Failure		+	+	+	+

Het Falende Hart in Beweging

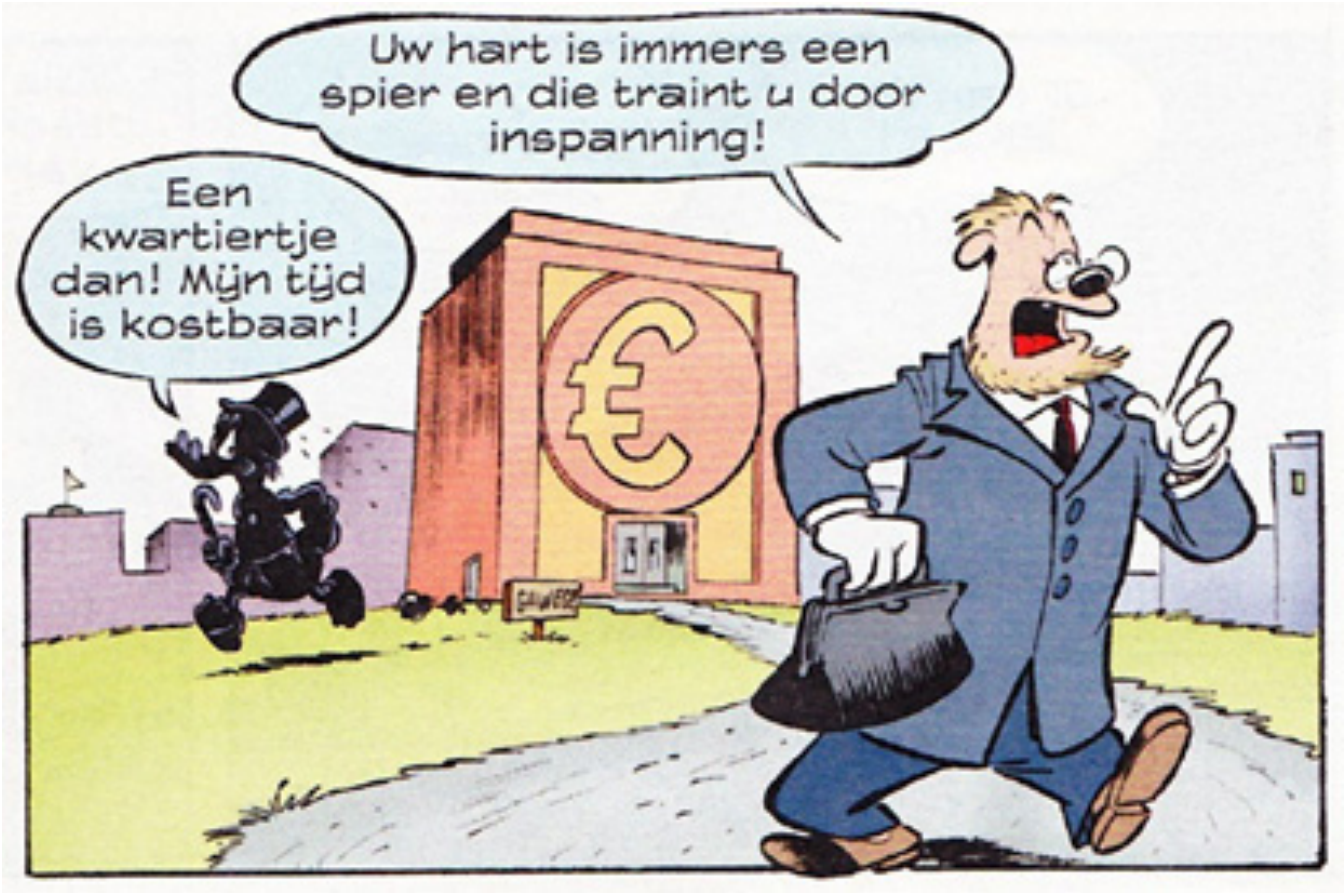
Fysieke training

Centrale effecten

reverse remodelling

	Exercise Training Group (n = 31)			Control Group (n = 33)		
	Baseline	6-Month Follow-up	*P* Value†	Baseline	6-Month Follow-up	*P* Value‡
LV-EDD, mm	69 (10)	66 (10)	.78	65 (9)	66 (9)	<.001
LV-ESD, mm	60 (10)	55 (10)	.54	55 (9)	56 (9)	<.001
LV-EDV, mL	229 (75)	207 (65)	.55	207 (66)	218 (68)	.008
LV-ESV, mL	161 (65)	137 (66)	.46	147 (56)	148 (56)	.009
LVEF	0.30 (0.08)	0.35 (0.09)	.43	0.30 (0.09)	0.33 (0.09)	.47

	Exercise Training Group (n=45)		Control Group (n=44)	
	Baseline	6 Months	Baseline	6 Months
EDV, mL/m^2	142±26	135±26*	147±41	156±42*†
ESV, mL/m^2	107±24	97±24*	110±34	118±34*‡
EF, %	25±4	29±4*	25±4	25±5‡


Uw hart is immers een spier en die traint u door inspanning!
Een kwartiertje dan! Mijn tijd is kostbaar!

Centrale effecten
reverse remodelling

TABLE 3. LV Volumes and Resting Hemodynamics

	Control		MCT		AIT	
	Baseline	Follow-Up	Baseline	Follow-Up	Baseline	Follow-Up
LVDD, mm	67.2±8.1	67.8±12.5	69.1±8.6	68.2±6.5	66.7±6.8	59.0±6.8*†
LVSD, mm	56.2±9.2	56.7±13.7	56.6±8.8	53.9±7.4	53.9±6.7	46.1±8.2*†
LVEDV, mL	250.5±64.4	242.1±62.3	245.5±53.1	230.3±41.0	248.1±79.6	202.9±72.0*†
LVESV, mL	187.8±53.0	186.6±58.6	172.9±48.7	160.6±34.3	177.4±72.1	133.9±57.8*†
HR at rest, bpm	60±11	59±11	55±10	54±12	65±14	61±13
SV, mL	53.4±15.3	55.0±13.7	63.5±12.7	63.1±15.7	57.1±14.3	67.0±19.9*
CO, L/min	3.1±0.6	3.2±0.5	3.5±0.9	3.4±1.1	3.5±0.5	3.9±0.6*
EF, %	26.2±8.0	26.6±9.7	32.8±4.8	33.5±5.7	28.0±7.3	38.0±9.8*†

Centrale effecten

coronaire perfusie

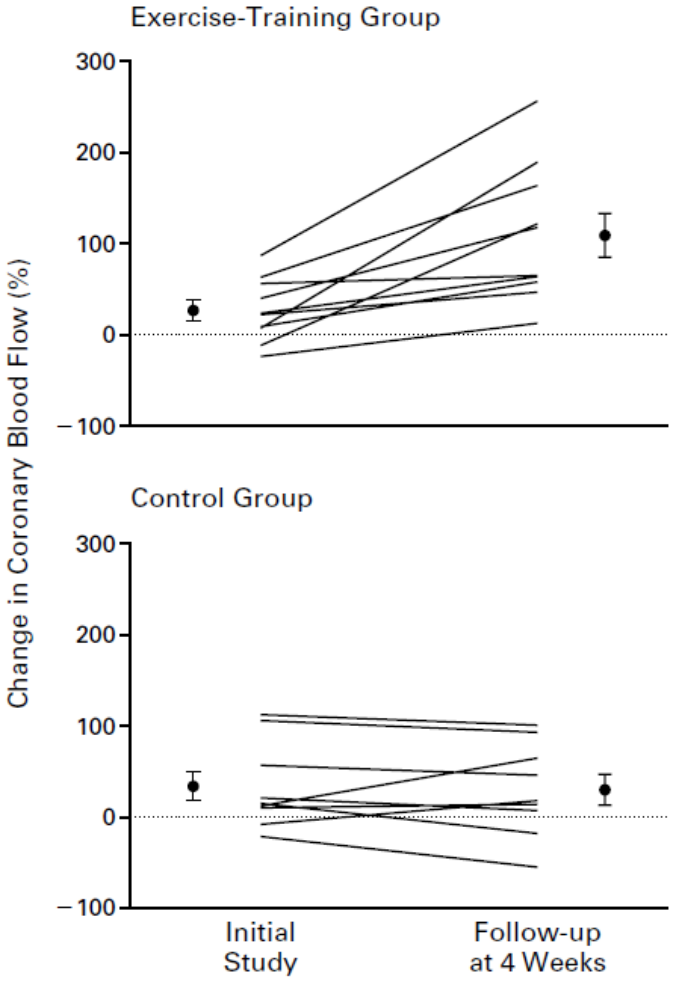
EFFECT OF EXERCISE ON CORONARY ENDOTHELIAL FUNCTION IN PATIENTS WITH CORONARY ARTERY DISEASE

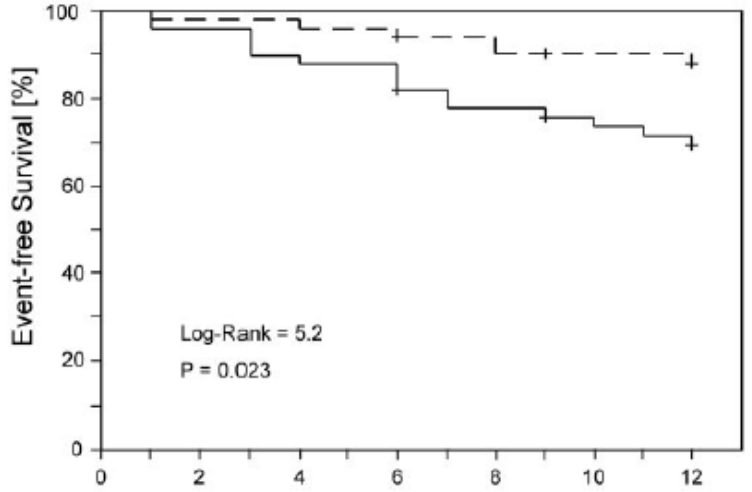
RAINER HAMBRECHT, M.D., ANAMARIA WOLF, M.D., STEPHAN GIELEN, M.D., AXEL LINKE, M.D., JÜRGEN HOFER, B.S., SANDRA ERBS, M.D., NINA SCHOENE, M.D., AND GERHARD SCHULER, M.D.

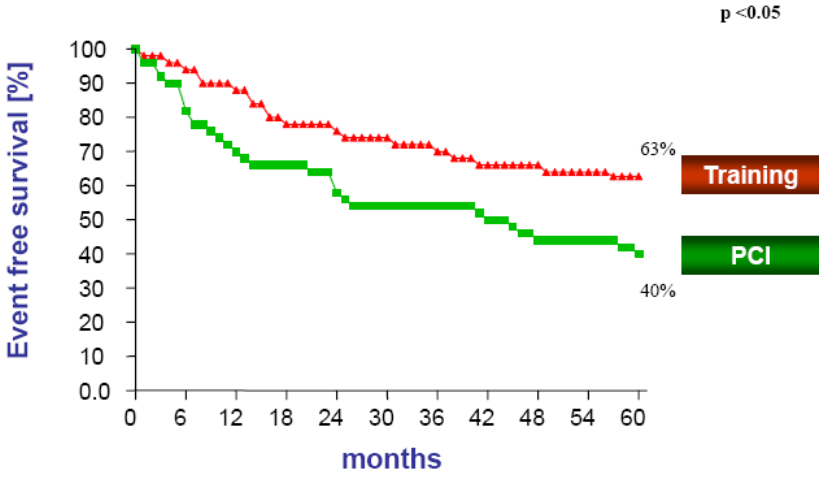
Percutaneous Coronary Angioplasty Compared With Exercise Training in Patients With Stable Coronary Artery Disease

A Randomized Trial

Rainer Hambrecht, MD; Claudia Walther, MD; Sven Möbius-Winkler, MD; Stephan Gielen, MD; Axel Linke, MD; Katrin Conradi, MD; Sandra Erbs, MD; Regine Kluge, MD; Kai Kendziorra, MD; Osama Sabri, MD; Peter Sick, MD; Gerhard Schuler, MD


Exercise-Training Group
Control Group
Change in Coronary Blood Flow (%)
300
200
100
0
−100
Initial Study
Follow-up at 4 Weeks

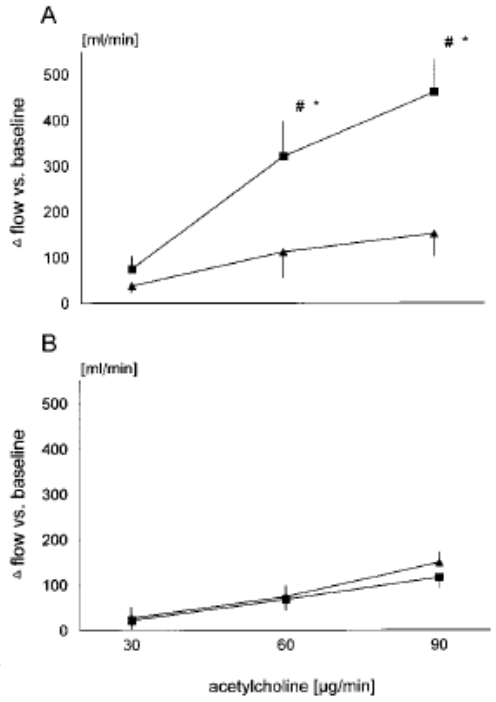

Event-free Survival [%]
100
80
60
40
20
0
0
2
4
6
8
10
12
Log-Rank = 5.2
P = 0.023

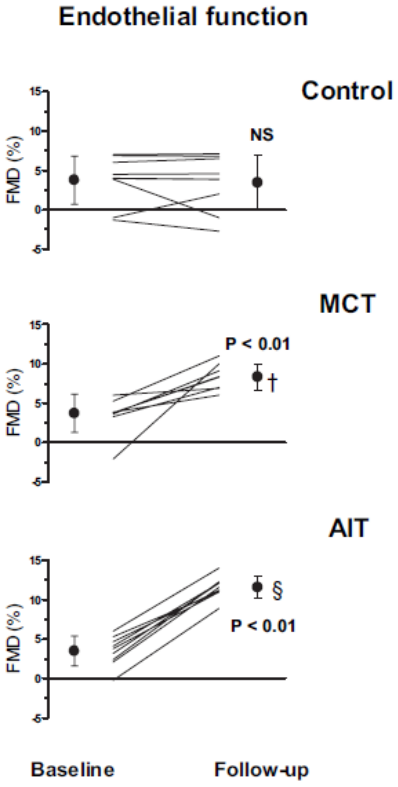

p <0.05
Event free survival [%]
100
90
80
70
60
50
40
30
20
10
0.0
0
6
12
18
24
30
36
42
48
54
60
months
63%
40%
Training
PCI

Perifere effecten
skeletspierdoorbloeding

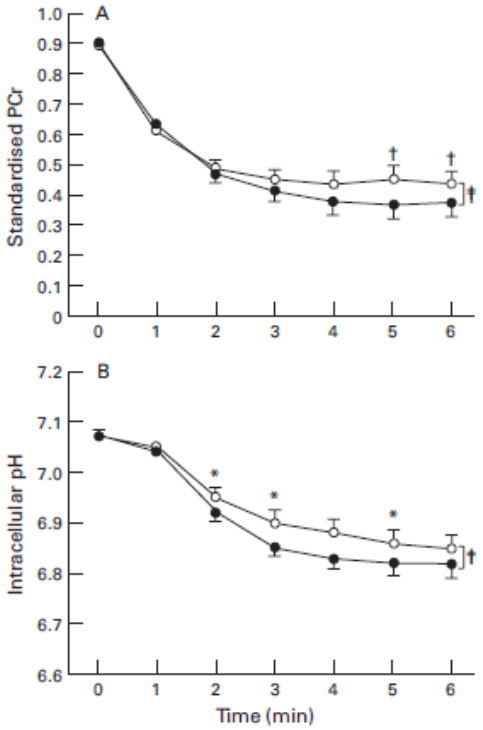
Regular Physical Exercise Corrects Endothelial Dysfunction and Improves Exercise Capacity in Patients With Chronic Heart Failure

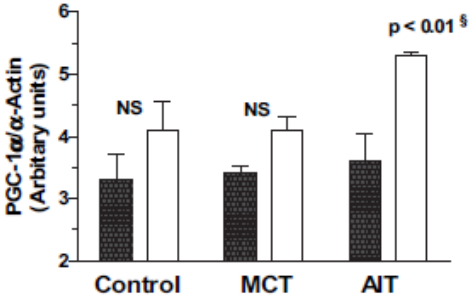
Rainer Hambrecht, MD; Eduard Fiehn, MD; Claudia Weigl, MD; Stephan Gielen, MD; Caroline Hamann, BS; Ralf Kaiser, BS; Jiangtao Yu, MD; Volker Adams, PhD; Josef Niebauer, MD; Gerhard Schuler, MD

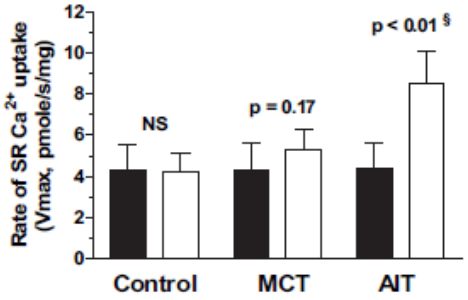




Perifere effecten
skeletspiermetabolisme

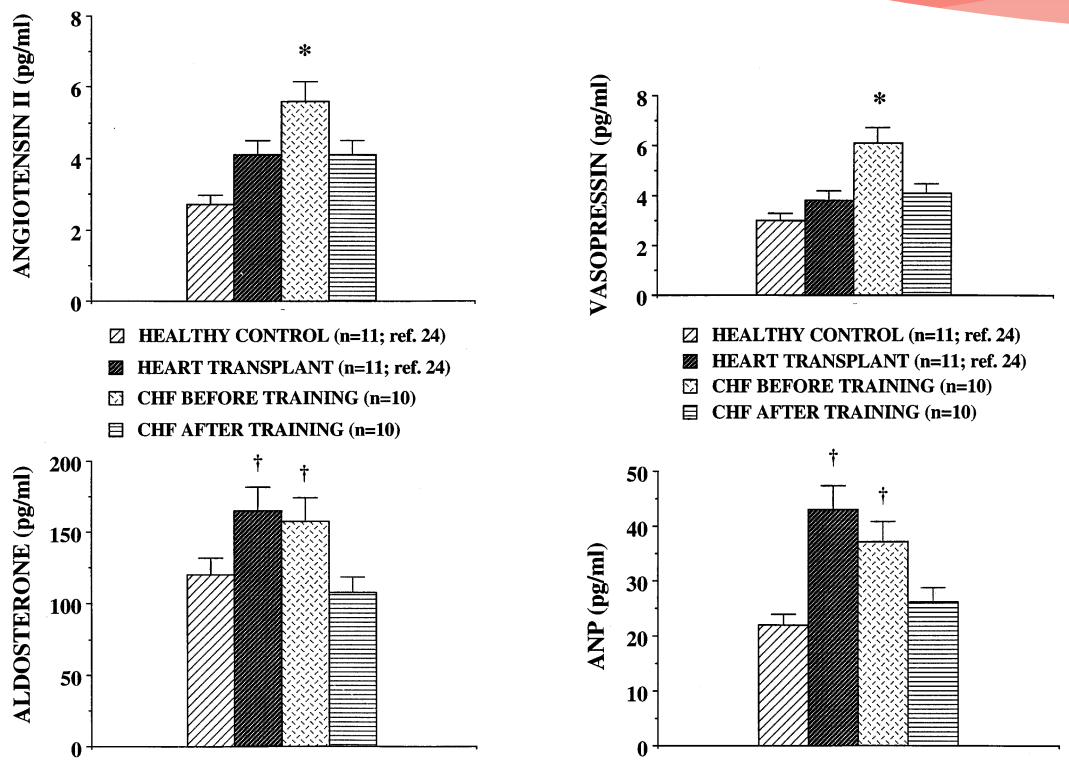






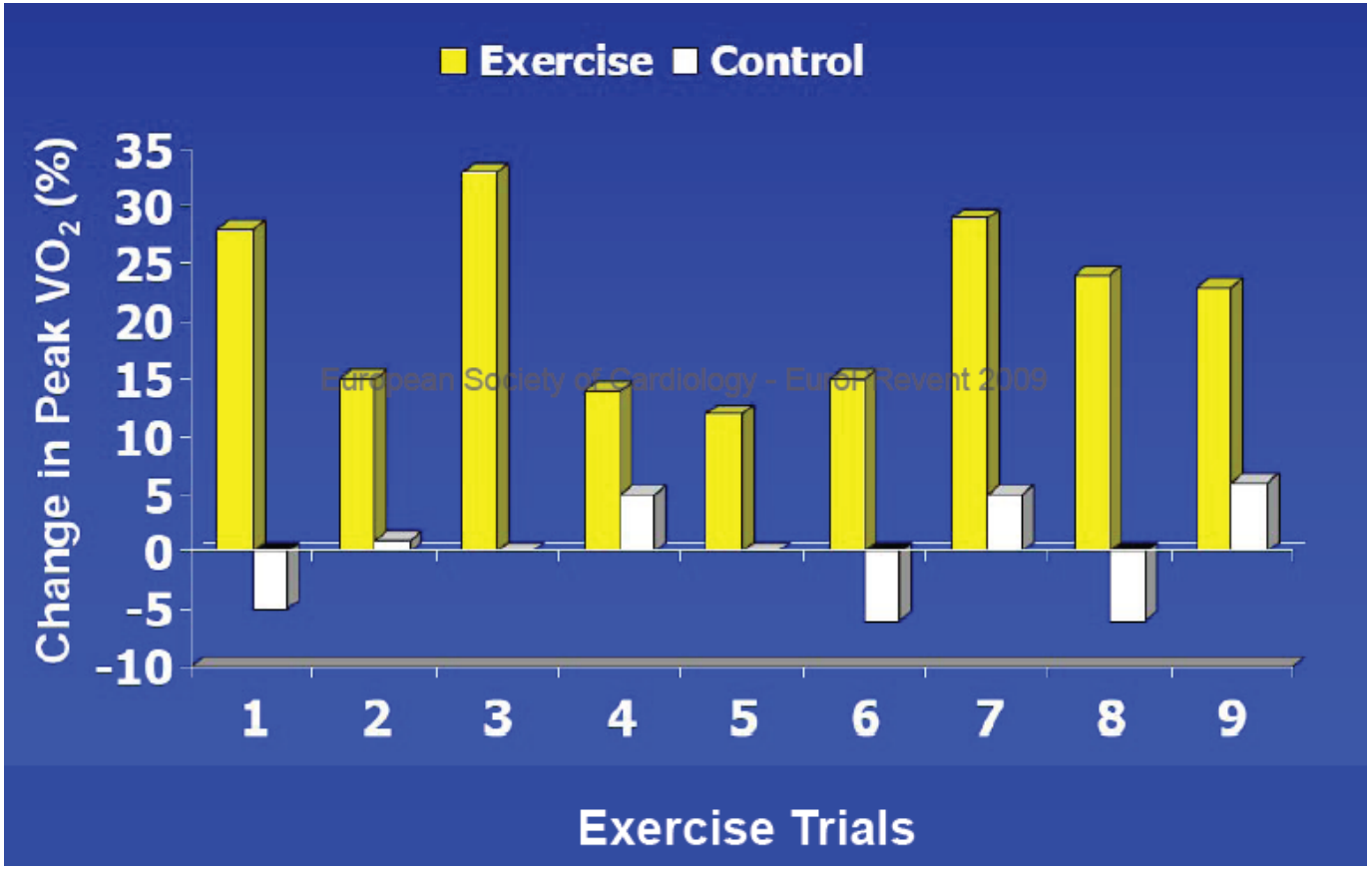
Variable	Baseline	6 Months	Change (%)
Training			
Fiber type I (%)	48 ± 7	52 ± 7*	4 ± 4 (8%)†
Fiber type II (%)	52 ± 7	48 ± 6*	4 ± 5 (−8%)†
Control			
Fiber type I (%)	49 ± 5	46 ± 7*	−3 ± 5 (−6%)
Fiber type II (%)	51 ± 5	54 ± 10	3 ± 6 (6%)

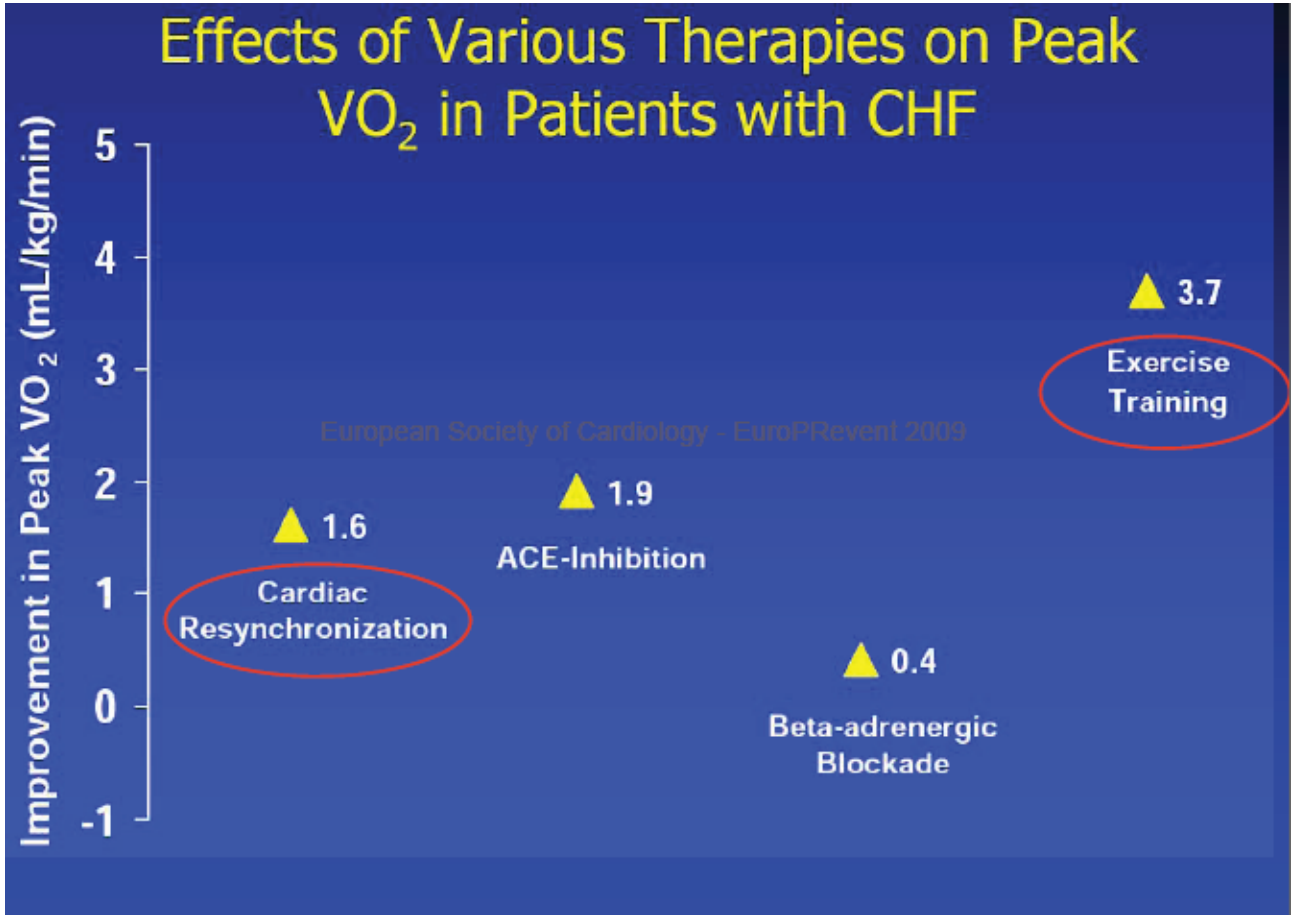
Perifere effecten
neurohormonaal



Fysieke training

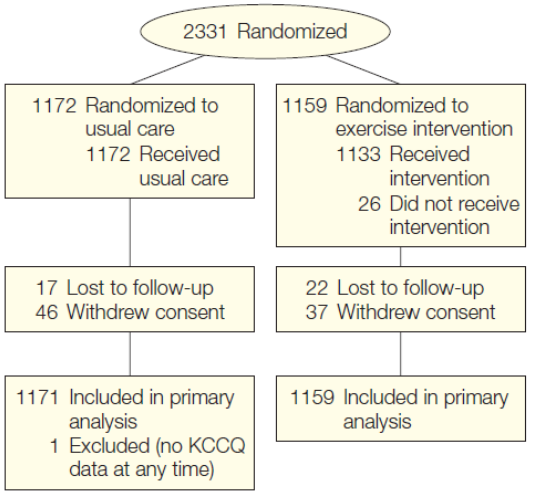
* Inspanningscapaciteit
* Kwaliteit van leven
* Prognose


Exercise
Control
Change in Peak VO_2 (%)
35
30
25
20
15
10
5
0
-5
-10
1
2
3
4
5
6
7
8
9
Exercise Trials
European Society of Cardiology - EuroPRevent 2009


Effects of Various Therapies on Peak VO_2 in Patients with CHF
Improvement in Peak VO_2 (mL/kg/min)
5
4
3
2
1
0
-1
1.6
Cardiac Resynchronization
1.9
ACE-Inhibition
0.4
Beta-adrenergic Blockade
3.7
Exercise Training
European Society of Cardiology - EuroPRevent 2009

Fysieke training
kwaliteit van leven

HF-ACTION (Flynn 2009 JAMA)



KCCQ indicates Kansas City Cardiomyopathy Questionnaire.

CHANGE (Wielenga 2008 Heart Fail Rev)

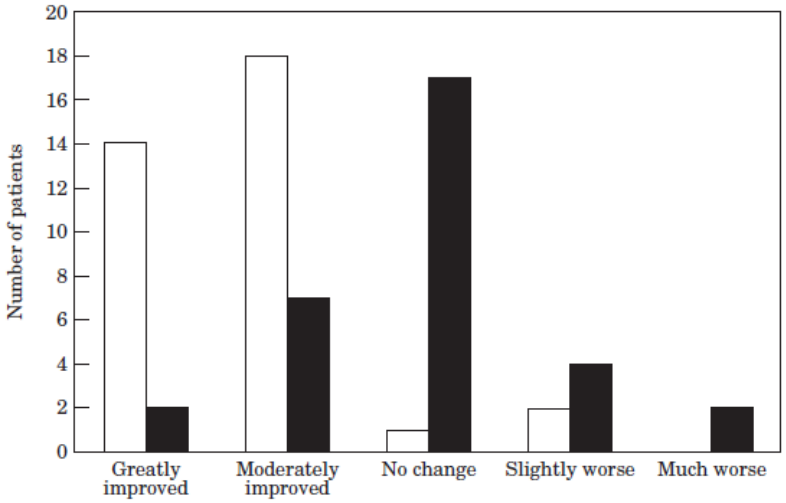


Figure 1 Overall assessment of general well-being. □=training; ■=control.

Conclusions Exercise training conferred modest but statistically significant improvements in self-reported health status compared with usual care without training. Improvements occurred early and persisted over time.

Fysieke training
prognose

bmj.com **Exercise training meta-analysis of trials in patients with chronic heart failure (ExTraMATCH)**

Training 3-7x / week

8 weken – 1 jaar

60-80% peak VO2 / HF

Interventie: 88 overleden (mediane tijd tot event: 618 dagen)

Controle: 105 overleden (mediane tijd tot event: 421 dagen)

NNT: 17 (2 jaar)

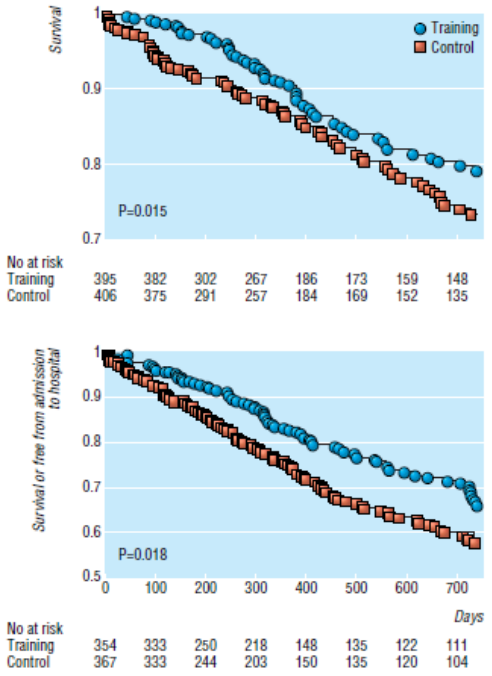
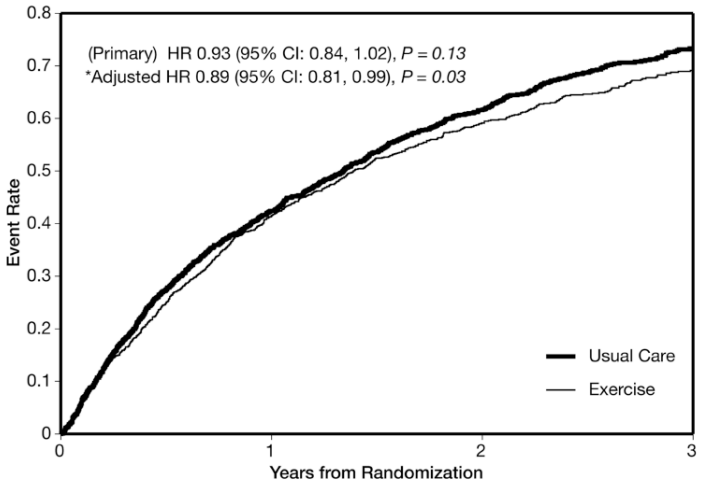


Fig 3 Kaplan-Meier cumulative two year survival (top) and Kaplan-Meier cumulative two year survival or free from admission to hospital (bottom)

Training 5x / week, na 3 maanden home based

60% heart rate reserve, 3x30 min



Adverse Event	Usual Care (N = 1171)[a]	Exercise Training (N = 1159)
Prespecified Cardiovascular Adverse Events		
Worsening heart failure, No. (%)	340 (29.0)	303 (26.1)
Myocardial infarction, No. (%)	45 (3.8)	41 (3.5)
Unstable angina, No. (%)	88 (7.5)	86 (7.4)
Serious adverse arrhythmia, No. (%)[b]	164 (14.0)	167 (14.4)
Stroke, No. (%)	28 (2.4)	33 (2.8)
Transient ischemic attack, No. (%)	23 (2.0)	20 (1.7)
Any of the above events, No. (%)	471 (40.0)	434 (37.4)
General Adverse Events		
Hospitalization for fracture of the hip or pelvis, No. (%)	7 (0.6)	3 (0.3)
Outpatient fracture repair, No. (%)	20 (1.7)	13 (1.1)
ICD firing, No. fired/No. with ICD (%)	151/644 (23.0)	142/641 (22.2)
Hospitalization after exercise, No. (%)[c]	22 (1.9)	37 (3.2)
Death after (or unknown if after) exercise, No. (%)[d]	5 (0.4)	5 (0.4)

Trainingsvormen

* Aerobe en interval training
* Krachttraining
* Inspiratory muscle training

Aerobe en interval training
maakt intensiteit uit?

* HF-ACTION (2009)
  * Moderate Intensity Continuous Training (MIT of CT)
* Meyer (1996)
  * Supra Hoog-intensieve Interval Training (HIIT)
* Wisløff (2007)
  * Aerobe Interval Training (AIT)

CT (HF-ACTION)

Efficacy and Safety of Exercise Training in Patients With Chronic Heart Failure: HF-ACTION Randomized Controlled Trial

Christopher M. O'Connor, MD, David J. Whellan, MD, MHS, Kerry L. Lee, PhD, Steven J.

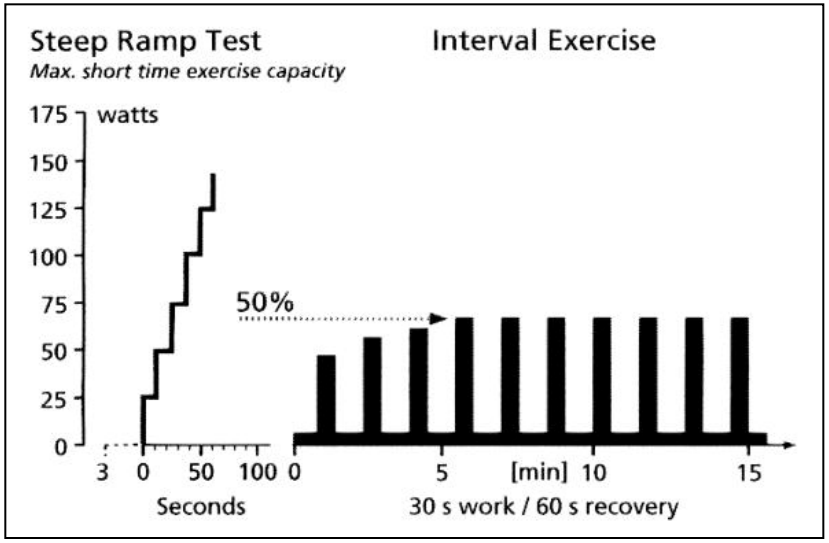
Change in 6-Minute Walk Test and Cardiopulmonary Exercise Test Results[a]

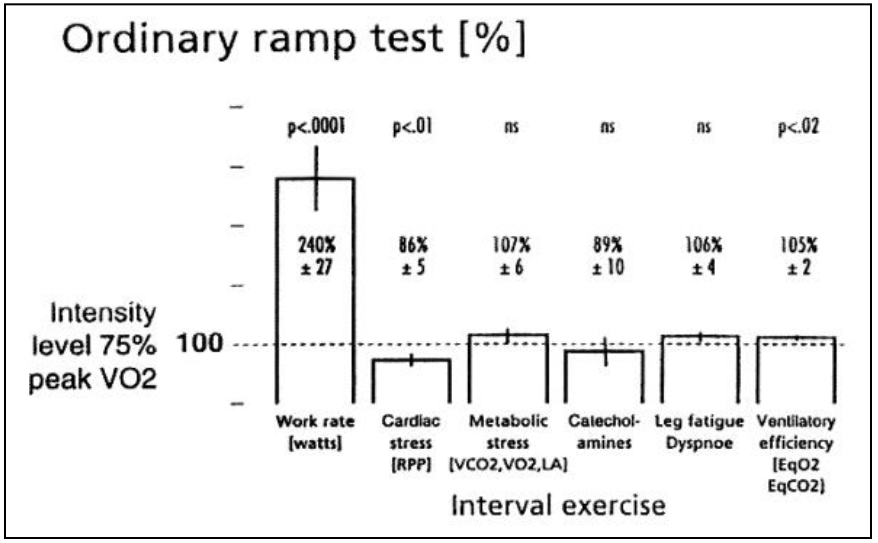
	Median (IQR)		
Test	**Usual Care**	**Exercise Training**	***P* Value**
Baseline to 3 months[a]			
Six-minute walk distance, m (n = 1835)	5 (−28, 37)	20 (−15, 57)	< .001
Cardiopulmonary exercise duration, min (n = 1914)	0.3 (−0.6, 1.4)	1.5 (0.3, 3.0)	< .001
Peak VO_2, mL/kg//min (n = 1870)	0.2 (−1.2, 1.4)	0.6 (−0.7, 2.3)	< .001
Baseline to 12 months[a]			
Six-minute walk distance, m (n = 1444)	12 (−30, 55)	13 (−28, 61)	.26
Cardiopulmonary exercise duration, min (n = 1476)	0.2 (−1.0, 1.7)	1.5 (0.0, 3.2)	< .001
Peak VO_2, mL/kg//min (n = 1442)	0.1 (−1.5, 1.8)	0.7 (−1.0, 2.5)	< .001

HIIT (Meyer)

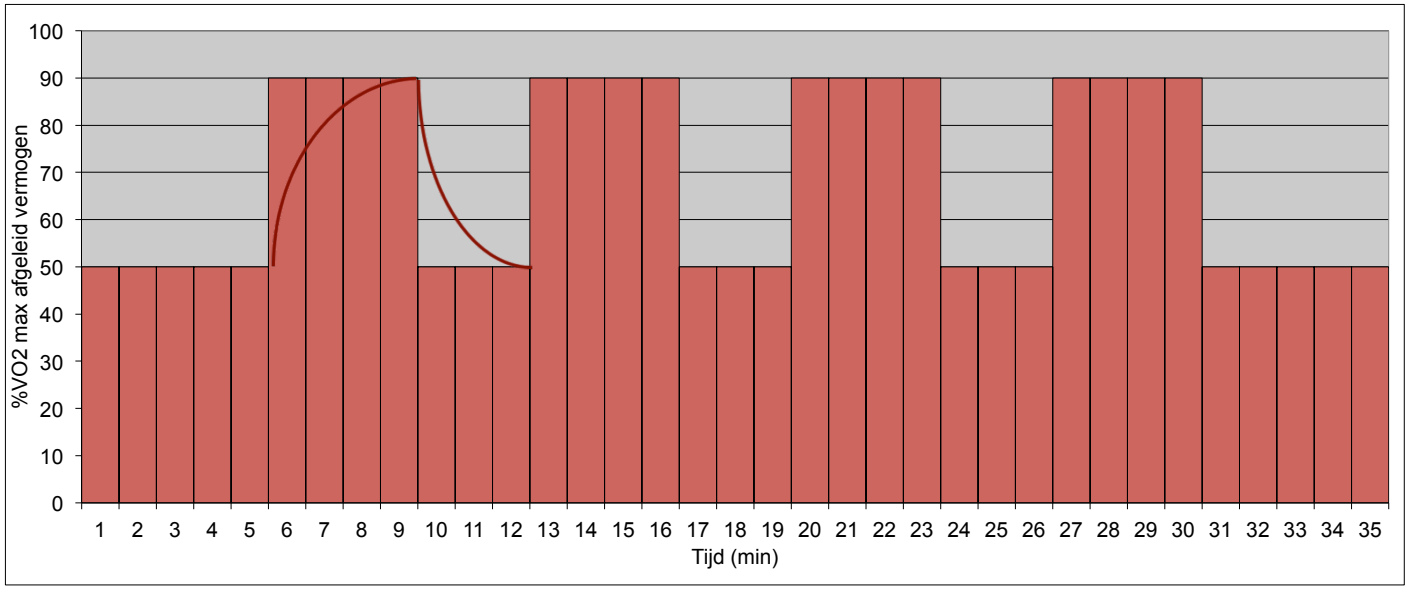
Interval training in patients with severe chronic heart failure: analysis and recommendations for exercise procedures.
MEYER, KATHARINA; SAMEK, LADISLAUS; SCHWAIBOLD, MATTHIAS; WESTBROOK, SAMUEL; HAJRIC, RAMIZ; BENEKE, RALPH; LEHMANN, MANFRED; ROSKAMM, HELMUT

Medicine & Science in Sports & Exercise. 29(3):306-312, March 1997.





AIT (Wisløff)


100
90
80
70
60
50
40
30
20
10
0
%VO2 max afgeleid vermogen
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
Tijd (min)

AIT (Wisløff)

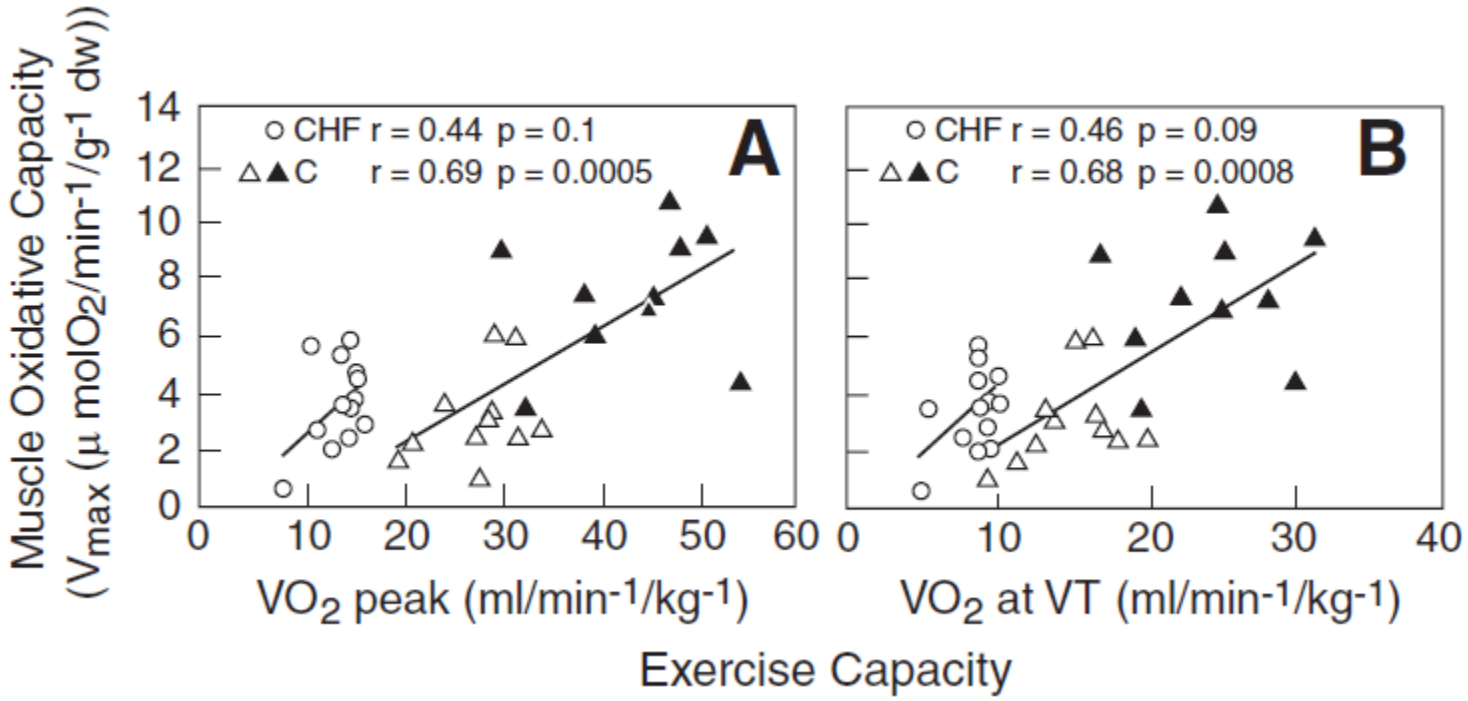
TABLE 2. Aerobic Capacity and Exercise Data

	Control		MCT		AIT	
	Baseline	Follow-Up	Baseline	Follow-Up	Baseline	Follow-Up
Peak treadmill test						
$\dot{V}o_{2peak}$, mL · kg^{-1} · min^{-1}	13.2±1.9	13.4±2.0	13.0±1.1	14.9±0.9*	13.0±1.6	19.0±2.1*†
Peak heart rate, bpm	129±23	127±21	132±18	130±21	129±19	127±22
$[La^-]_b$ at $\dot{V}o_{2peak}$, mmol/L	6.3±1.6	6.3±1.2	6.8±1.2	6.4±1.0	6.2±0.8	6.0±0.6
RER at $\dot{V}o_{2peak}$	1.10±0.04	1.11±0.04	1.10±0.04	1.09±0.05	1.08±0.05	1.11±0.04
Anaerobic threshold						
% Of peak oxygen uptake	64±6	65±4	61±3	68±4*‡	63±5	61±3
mL · kg^{-1} · min^{-1}	8.5±1.6	8.7±3.9	8.0±0.7	10.1±0.9*§	8.2±0.8	11.6±1.0*†

Hoe werkt AIT?

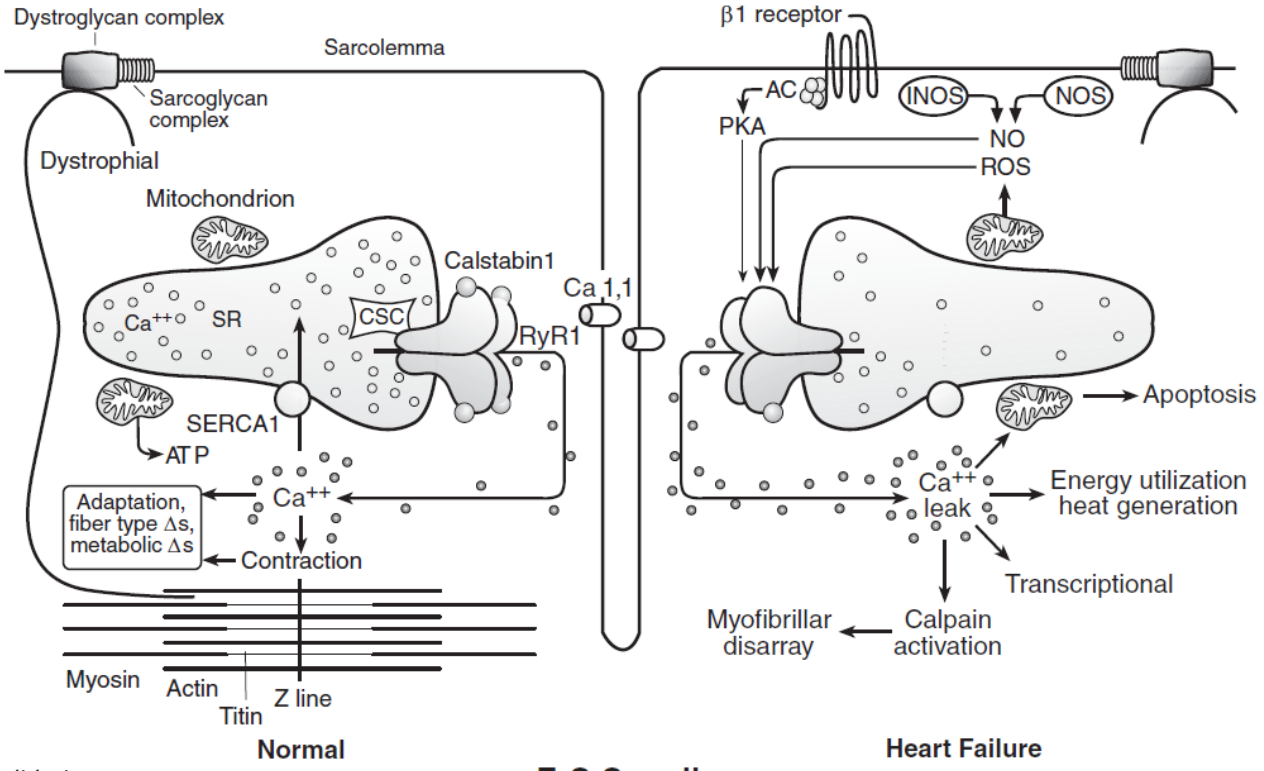
Hoe werkt AIT?

Oxidatieve capaciteit



Hoe werkt AIT?

Exitatie – Contractie Koppeling

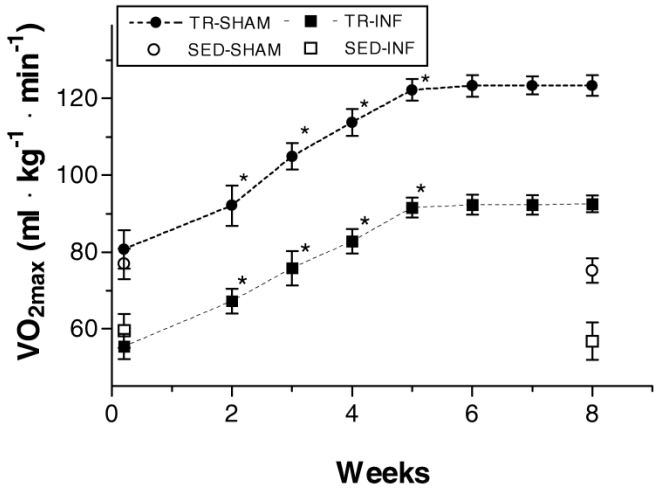


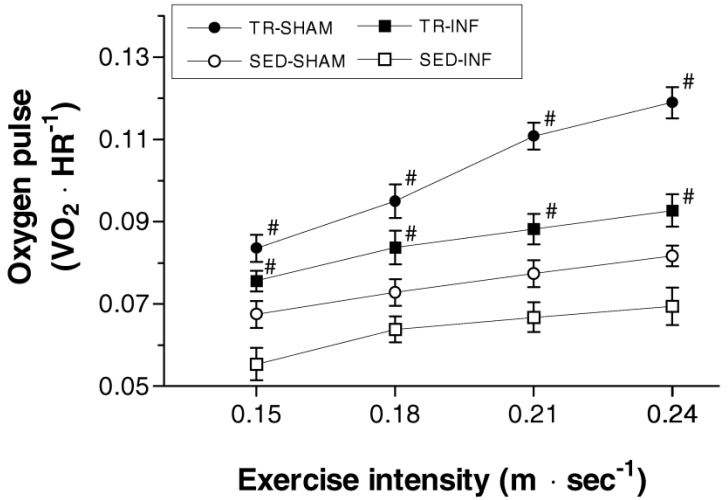
Hoe werkt AIT?

Hartspierfunctie

Aerobic exercise reduces cardiomyocyte hypertrophy and increases contractility, Ca^{2+} sensitivity and SERCA-2 in rat after myocardial infarction

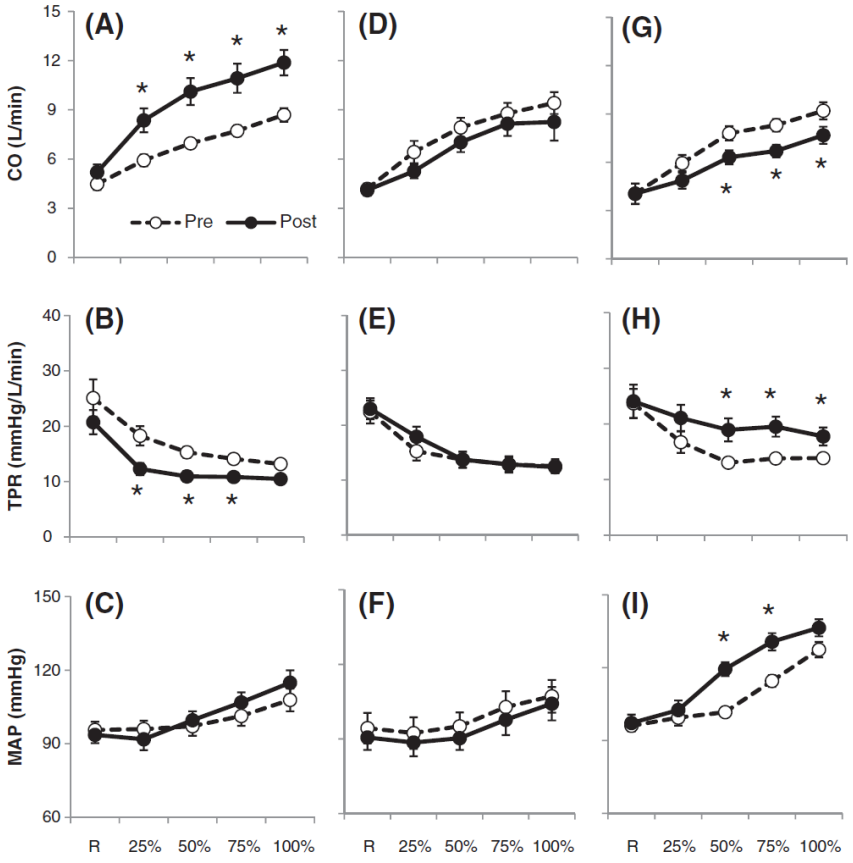
Ulrik Wisløff[a], Jan P. Loennechen[a], Susan Currie[b], Godfrey L. Smith[b], Øyvind Ellingsen[a,*]





Hoe werkt AIT?

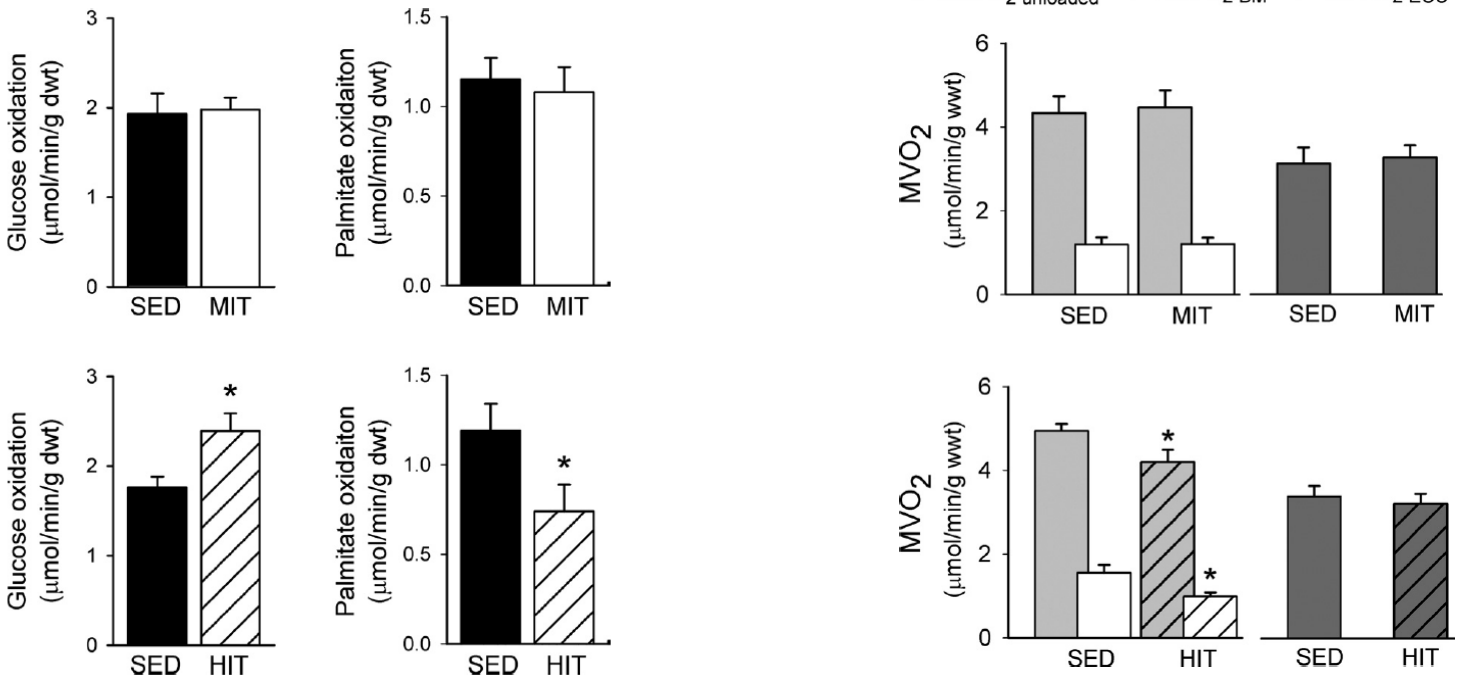
Hartspierfunctie



Hoe werkt AIT?
Hartspiermetabolisme

High intensity interval training alters substrate utilization and reduces oxygen consumption in the heart

A. D. Hafstad,[1] N. T. Boardman,[1] J. Lund,[1] M. Hagve,[1] A. M. Khalid,[1] U. Wisløff,[2,3] T. S. Larsen,[1,2] and E. Aasum[1]



Vergelijking HIT

Study	Intermittent exercise workload	Comparator	Weeks	Frequency	Mode	kcal week^{-1}	%Δ
						Int./Comparator	Peak VO_2
Anagnostakou [8]	30 s work:60 s rest 50% peak work (40 min)	Intermittent and strength training	12	Thrice week^{-1}	Cycle	135	9.6 vs 16.6
Bouchla [9]	30 s work:60 s rest 50% peak work (40 min)	Intermittent and strength training	12	Thrice week^{-1}	Cycle	138	8.2 vs 16.7
Delagradelle [7]	2 min 50% peak VO_2:2 min 75% peak VO_2 (40 min)	Intermittent and strength training	16	Thrice week^{-1}	Cycle	595	6.6 vs 0.5
Dimopoulos [10]	30 s work:30 s rest 100% peak work (40 min)	Continuous, 50% work rate, 40 mins	12	Thrice week^{-1}	Cycle	393	7.8 vs 5.8
Kemps [11]	30 s work:60 s rest x10 (15 min) 50% peak work	Sedentary control	12	Thrice week^{-1}	Cycle	110	8.6 vs −2.2
Meyer [12]	30 s work:60 s at 15 W 50% peak work (25 min)	Sedentary control	3	Five times weekly	Cycle & Walking	217	19.6 vs 3.2
Nechwatal [13]	30 s work:60 s at 15 W 50% peak work (15 min)	1. Sedentary control 2. Contin. 75% peak	3	Six times weekly	Cycling	198/198	8.1 vs 9.3 vs −0.6
Nilsson [14]	15–18 Borg Scale, 50 min	Sedentary control	16	Twice week^{-1}	Aerobic	N/A	N/A
Roditis [15]	30 s work:30 s rest 100% peak work (40 min)	Continuous, 50% work rate, 40 min	12	Thrice week^{-1}	Cycle	330	8.5 vs 8.5
Sabelis [16]	30 s work:60 s rest× 10 50% peak work, for 15 mins	Sedentary control	26	Four weekly	Cycle	110	3.6 vs −4.4
Smart [17]	60 s work:60 s rest 70% peak VO_2 (60 min)	Continuous, 70% work rate, 30 min	16	Thrice week^{-1}	Cycle	467/467	20.5 vs 10.2
Tasoulis [18]	30 s work:60 s rest (40 min)	1.Sedentary Control 2. Intermittent & strength training	12	Thrice week^{-1}	Cycle	Interval 277 Comb. N/A	Int. 13.5 Control 3.7 Comb.17.9
Willenheimer [19]	90 s work:30 s rest, 80% peak VO_2, start 15 min titrated to 45 min.	Sedentary control	16	2–3 weekly	Cycle	565	5.4 vs −0.7
Wisloff [4]	4 min work, 90–95% peak HR, 3 min recovery 50–70% peak HR (38 min)	1.Sedentary control 2. Contin. 75% peak HR, 47 min	12	Thrice week^{-1}	Walking	660/660	46 (int) vs 14.6 vs 1.5 (control)

HIT vs beweegadvies

Study or Subgroup	Intermittent Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Kemps 2010	1.5	1.8	30	-0.4	3.1	18	8.3%	1.90 [0.33, 3.47]
Meyer 1996	2.6	2.28	9	0.3	0.39	9	9.0%	2.30 [0.79, 3.81]
Nechwatal 2002	1.5	3.2	20	-0.1	0.14	10	10.4%	1.60 [0.19, 3.01]
Sabelis 2004	0.7	2.07	36	-0.8	1.94	25	19.8%	1.50 [0.48, 2.52]
Tasoulis 2010	1.4	2.1	21	0.6	0.89	11	18.9%	0.80 [-0.24, 1.84]
Willenheimer 1998	0.9	2.03	22	-0.1	0.25	27	28.1%	1.00 [0.15, 1.85]
Wisloff 2007	6	1.66	9	0.2	2.41	9	5.6%	5.80 [3.89, 7.71]
Total (95% CI)			**147**			**109**	**100.0%**	**1.58 [1.13, 2.04]**

Heterogeneity: $Chi^2 = 23.70$, df = 6 (P = 0.0006); $I^2 = 75\%$

Test for overall effect: Z = 6.86 (P < 0.00001)

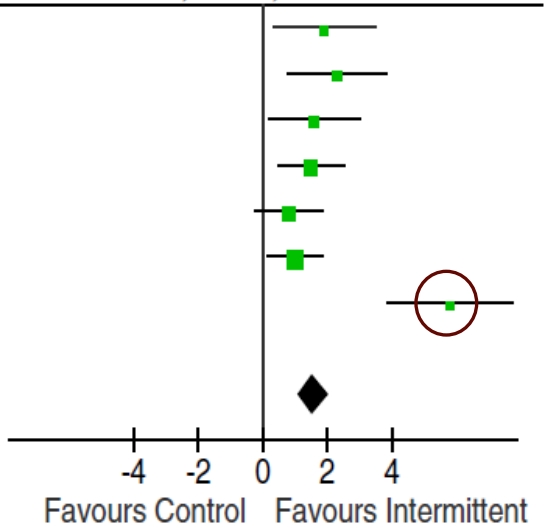


Fig. 2. Change in peak VO_2 for intermittent versus sedentary control.

HIT vs MIT / CT

Study or Subgroup	Intermittent Mean	SD	Total	Continuous Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Dimopoulos 2006	1.2	1.35	10	0.9	1.12	14	36.4%	0.30 [-0.72, 1.32]
Nechwatal 2002	1.5	2.82	20	1.6	2.31	20	14.9%	-0.10 [-1.70, 1.50]
Roditis 2007	1.2	1.57	11	1.3	1.6	10	20.6%	-0.10 [-1.46, 1.26]
Smart 2011	2.5	3.1	10	1.3	2.72	13	6.5%	1.20 [-1.22, 3.62]
Wisloff 2007	6	1.66	9	1.9	1.16	9	21.7%	4.10 [2.78, 5.42]
Total (95% CI)			60			66	100.0%	1.04 [0.42, 1.66]

Heterogeneity: $Chi^2 = 27.24$, $df = 4$ ($P < 0.0001$); $I^2 = 85\%$

Test for overall effect: $Z = 3.31$ ($P = 0.0009$)

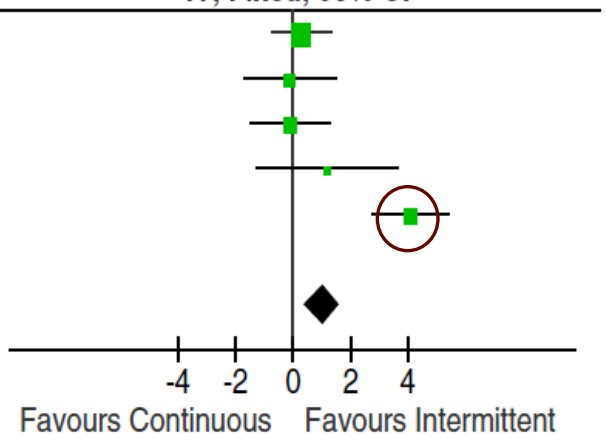


Fig. 3. Change in peak VO_2 for intermittent versus continuous exercise training.

Krachttraining

Randomized trial of progressive resistance training to counteract the myopathy of chronic heart failure

CHARLES T. PU,[1,2,3] MEREDITH T. JOHNSON,[1,3] DANIEL E. FORMAN,[3,4] JEFFREY M. HAUSDORFF,[5] RONENN ROUBENOFF,[1] MONA FOLDVARI,[1] ROGER A. FIELDING,[1,6] AND MARIA A. FIATARONE SINGH[1,3,7]

A systematic review on the effects of moderate-to-high intensity resistance training in patients with chronic heart failure

Martijn A Spruit, Rose-Miek Eterman, Valery Hellwig, Paul Janssen, Emiel Wouters and Nicole Uszko-Lencer

Effect of Resistance Exercise on Skeletal Muscle Myopathy in Heart Transplant Recipients

Randy W. Braith, PhD, Peter M. Magyari, PhD, Gary L. Pierce, MS, David G. Edwards, PhD, James A. Hill, MD, Lesley J. White, PhD, and Juan M. Aranda, Jr., MD

HIT vs HIT + krachttraining

Study or Subgroup	Intermittent Mean	SD	Total	Combined Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Anagnostakou 2011	1.5	2.3041	14	2.6	3	14	13.6%	-1.10 [-3.08, 0.88]
Bouchla 2011	1.3	1.8	10	2.3	3.2	10	10.3%	-1.00 [-3.28, 1.28]
Delagardelle 2002	0.1	0.14	10	1.1	1.54	10	58.3%	-1.00 [-1.96, -0.04]
Tasoulis 2010	1.4	2.1	21	2.9	3.8	25	17.7%	-1.50 [-3.24, 0.24]
Total (95% CI)			**55**			**59**	**100.0%**	**-1.10 [-1.83, -0.37]**

Heterogeneity: $Chi^2 = 0.25$, df = 3 (P = 0.97); $I^2 = 0\%$

Test for overall effect: Z = 2.95 (P = 0.003)

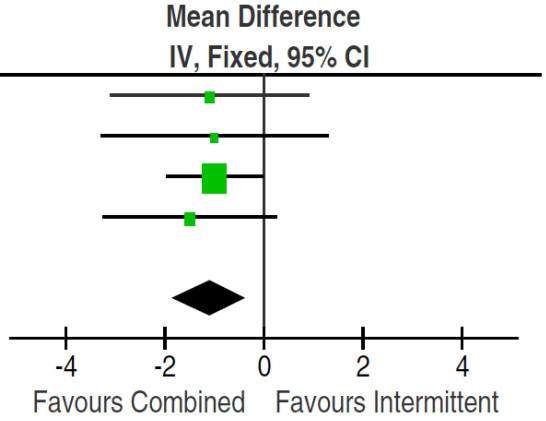


Fig. 4. Change in peak VO_2 for intermittent only versus combined training.

Ademhalingstraining

* Inspiratory muscle training

* *Pi max*
  * < 70% Pi max predicted
* *Training*
  * 30 min/dag
  * 2-3x/week
  * 20-40% Pi max

Het Falende Hart in Beweging

Inspanningsdiagnostiek

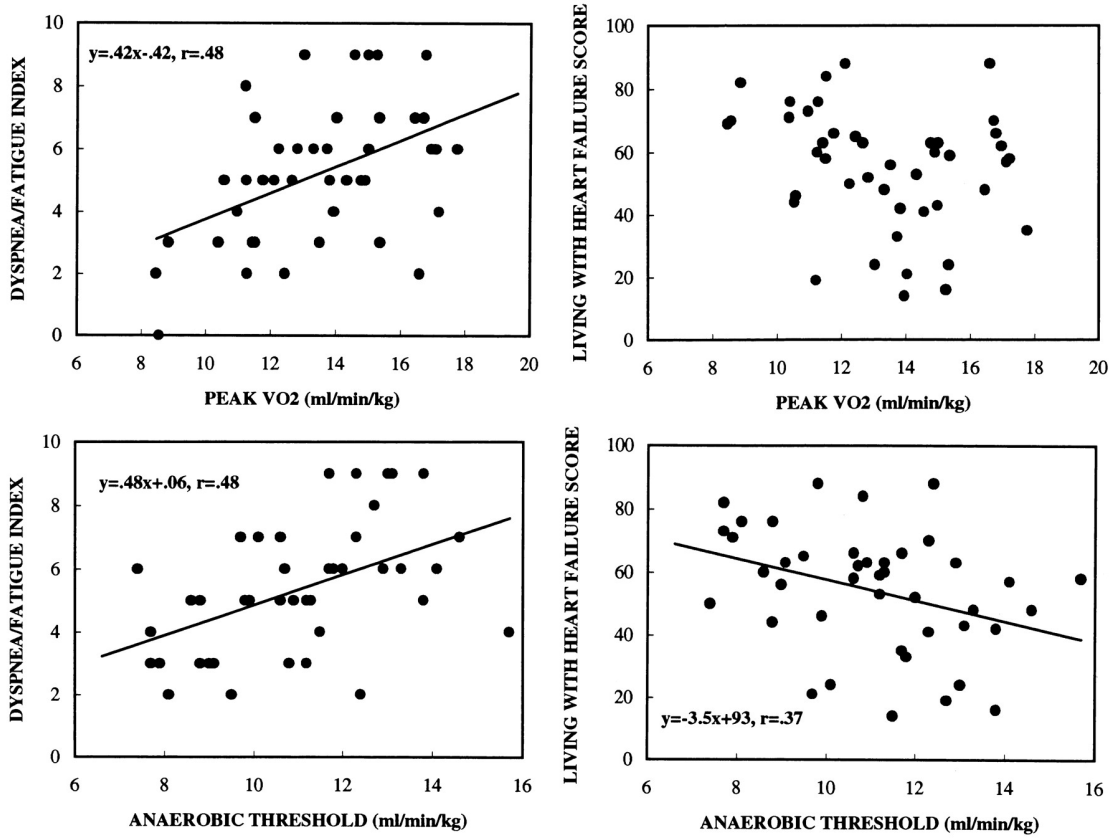
Spiro-ergometrie bij CHF

1. Objectiveren inspanningsvermogen / aansturen training
2. Vaststellen eventuele contra-indicaties voor training
3. Vaststellen aard beperking (co-morbiditeit)
4. Evalueren prognose

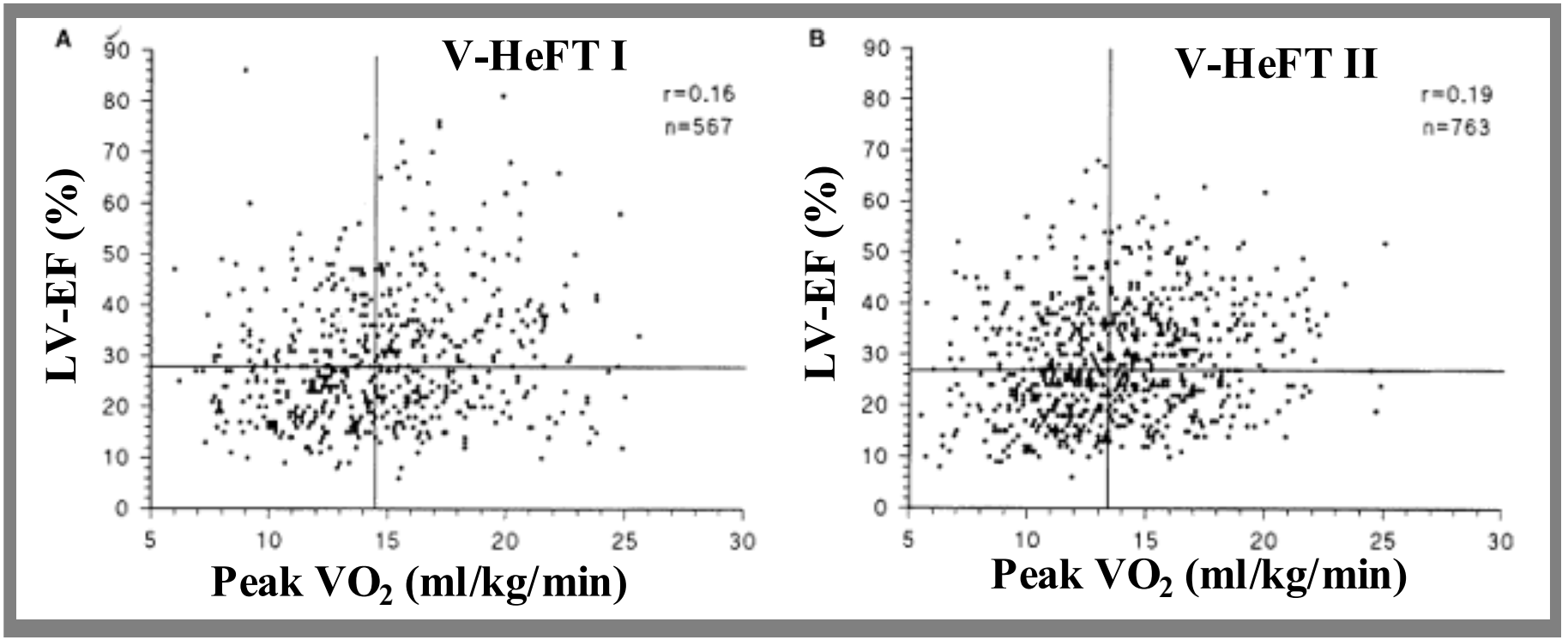
Objectiveren inspanningsvermogen

1. Zwakke correlatie subjectieve beleving inspanningstolerantie en objectieve inspanningscapaciteit
2. Geen correlatie LVEF en objectieve inspanningscapaciteit
3. Maximale aërobe capaciteit bij CHF niet goed te voorspellen door maximale vermogen

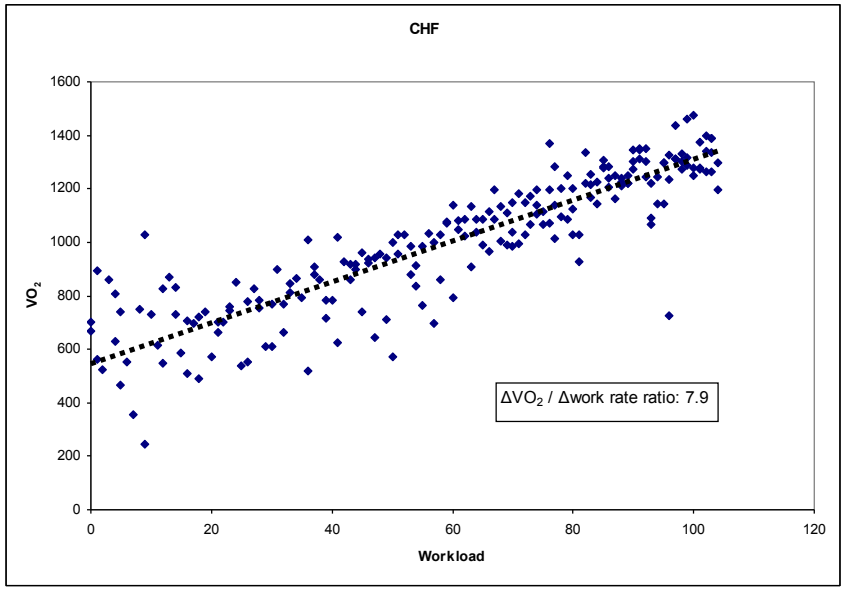
1. Zwakke correlatie subjectieve beleving inspanningstolerantie en objectieve inspanningscapaciteit (Wilson et al. Circulation 1995)

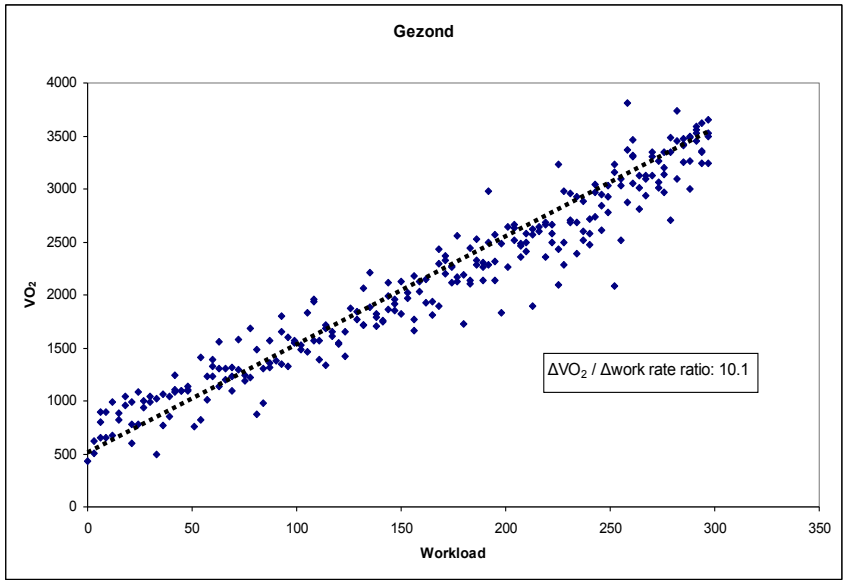


2. Geen correlatie LVEF en objectieve inspanningscapaciteit (Smith et al. Circulation 1993)



3. Maximale aërobe capaciteit bij CHF niet goed te voorspellen door maximale vermogen





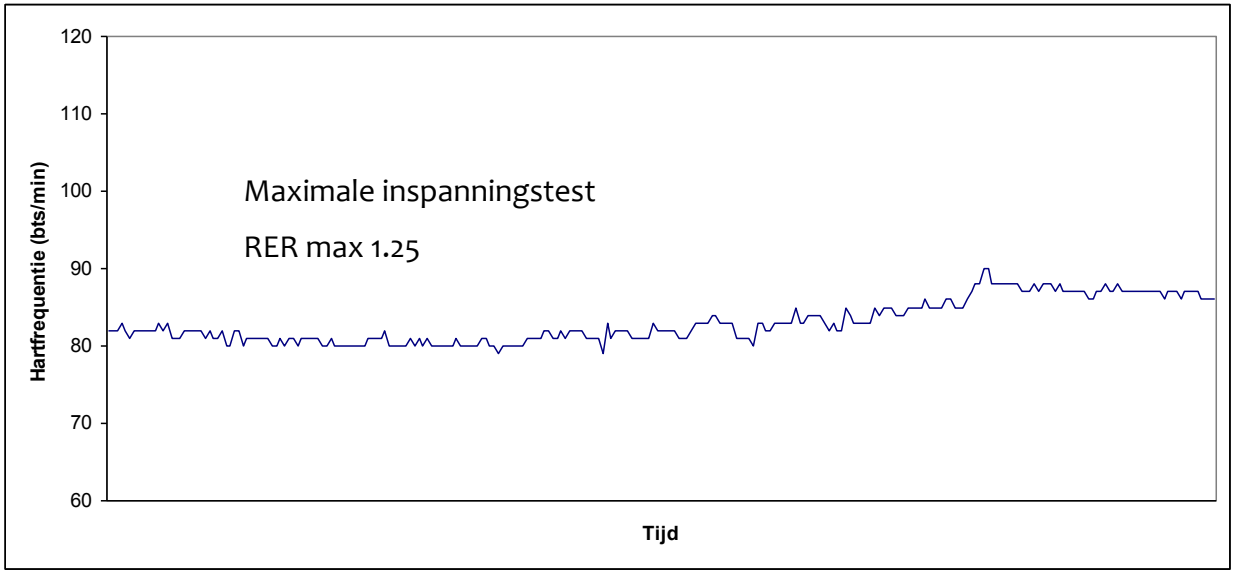
Objectiveren inspanningsvermogen

* Peak VO_2
  * gemiddelde VO_2 in laatste 20-30 sec van een RAMP test
  * Bij goed uitgevoerde test objectieve reproduceerbare maat voor het maximale inspanningsvermogen

Aansturen training

1. Percentage peak VO_2
2. Percentage ventilatoire drempel

Hartfrequentie is vaak niet bruikbaar!



Position paper European Society Cardiology 2009:

Monitoring exercise intensity: HR can be used for exercise prescription, but its applicability is limited in patients with advanced HF (chronotropic incompetence), in those treated with β-blockers and when atrial fibrillation is coexisting

Meten van trainingseffecten
- welke parameters? -

	Intervention group ($N = 30$)		Control group ($N = 18$)		P value between-group difference
	Baseline	Change	Baseline	Change	
Symptom-limited exercise test					
Peak $\dot{V}O_2$ (ml kg^{-1} min^{-1})	17.5 ± 3.1	1.5 ± 1.8*	18.5 ± 4.4	−0.4 ± 3.1	0.01
Peak workload (W)	107 ± 30	10 ± 11*	106 ± 38	6 ± 13	0.25
Peak $\dot{V}_E$ (l min^{-1})	63 ± 19	6 ± 13*	64 ± 15	−2 ± 9	0.03
Peak HR (beats min^{-1})	125 ± 22	1 ± 9	131 ± 23	−1 ± 13	0.66
Peak RER	1.12 ± 0.10	0.04 ± 0.10*	1.11 ± 0.10	0.05 ± 0.07*	0.82
VAT (ml kg^{-1} min^{-1})	12.2 ± 1.7	1.3 ± 1.4*	13.4 ± 2.9	−0.9 ± 2.1	<0.001
OUES	1737 ± 442	106 ± 229*	1639 ± 654	−58 ± 313	0.04
$\dot{V}_E/\dot{V}CO_2$ slope	35.7 ± 6.5	−1.8 ± 4.2*	38.9 ± 7.4	−1.8 ± 5.2	0.98
Constant-load exercise test					
τ-rec (s)	78 ± 30	−11 ± 23*	72 ± 23	5 ± 10	0.01

Kemps et al. Eur J Appl Physiol 2010

Specifieke aanbevelingen

* ICD
  * 20 slagen onder interventie zone (cave AFib)
  * Schoudermobiliteit
* CRT
  * Instellingen bij inspanning (positief complex V1)
* LVAD
  * Pulsatile vs continuous flow
* Hart transplantatie
  * Chronotrope incompetentie (denervatie)

Take home message

* Spier is ook ziek in CHF
  * Krachttraining werkt echter slechts beperkt
* Individueel voorschrijven trainingsvorm
  * Hoog intensief training is mogelijkheid
  * HR alleen bruikbaar bij chronotrope competentie
  * Cave ICD
* Spiro-ergometrie is zinvol en sterk aanbevolen
  * Richtlijn hartrevalidatie

Advies

* Meyer 2013 Current heart failure reports:
  * “analogous to optimizing pharmacotherapy, combining and tailoring different exercise training modalities according to each patient’s baseline exercise capacity, personal needs, preferences and goals seem the most judicious approach to exercise prescription”

Antwoorden

Vraag	Score	Antwoord	Verschil (abs)
1			
2			
3			
4			
5			
6a			
6b			
som			