

**La aplicación del Entrenamiento de Intervalos de Alta intensidad (HIIT) en el tratamiento de enfermedades vasculares, con trasplante de corazón o patologías neurodegenerativas.**

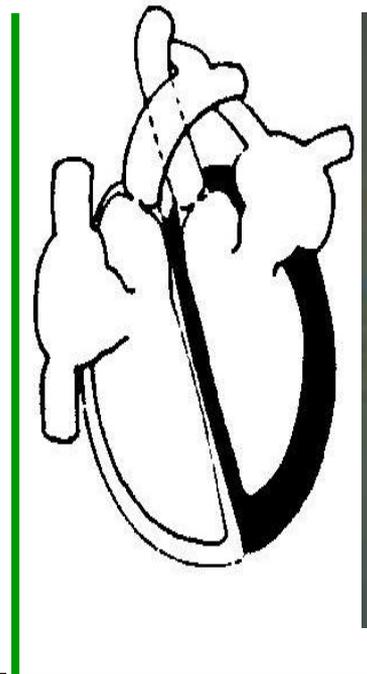
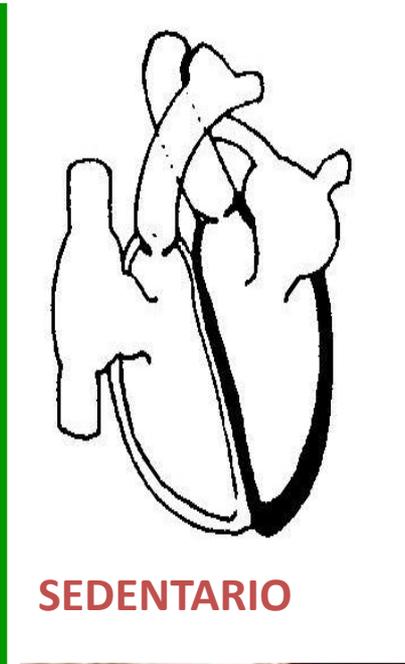
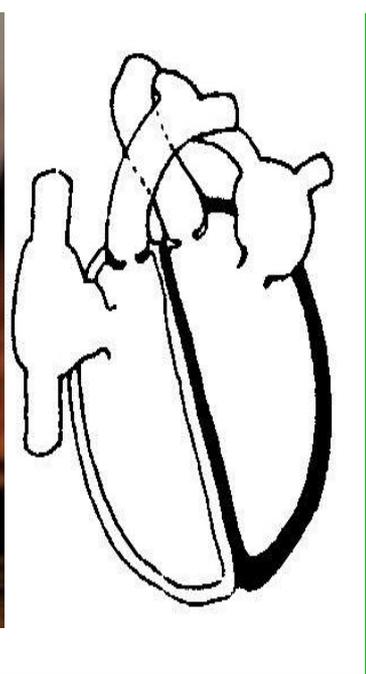
# Antecedentes de HIIT

- El **fartlek** (juego de velocidad en sueco) es un sistema de entrenamiento que consiste en hacer diversos ejercicios, tanto aeróbicos como anaeróbicos, principalmente ejercicios de carrera, caracterizados por los cambios de ritmo realizados a intervalos.
- Fue registrado por el sueco Gosse **Holmer** en 1930, pero puesto más en práctica y popularizado por **Gösta Olander** cerca de 1940.



# Adaptaciones fisiologicas inducidas por el HIIT

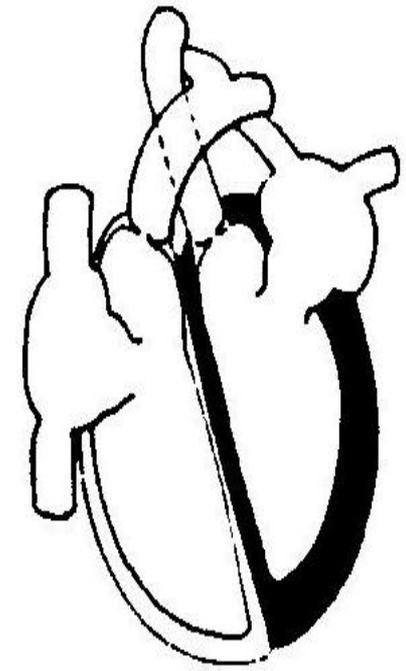
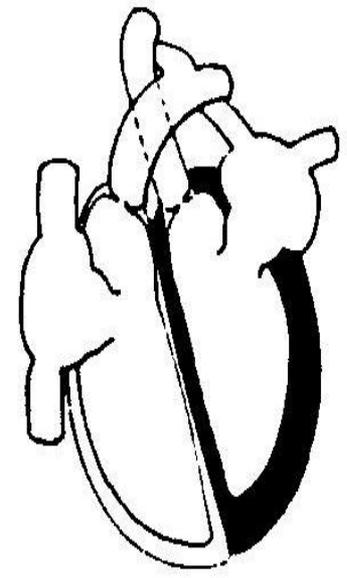
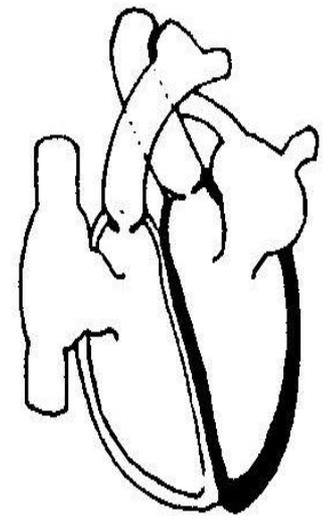
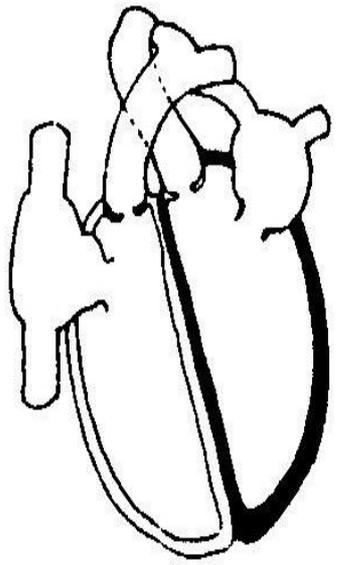
# HIPERTROFIA CARDIACA



**ADAPTACION AL  
ENTRENAMIENTO  
AERÓBICO**



**ADAPTACION AL  
ENTRENAMIENTO  
ANAERÓBICO**



# Investigaciones sobre HIIT vs Continuo en pacientes con enfermedades cardiacas

**Table 3 – Major results of the hemodynamic and cardiorespiratory variables found in the studies**

VARIABLES	HIIT		CON		Studies
	Pre	Post	Pre	Post	
HR at rest	-	-	-	-	Haykowsky et al., 2009
	76 ± 11	76 ± 7 (NS)	78 ± 7	78 ± 11 (NS)	Hermann et al., 2011
	85 ± 11	83 ± 11 (NS)	79 ± 11	81 ± 13 (NS)	Nytroen et al., 2012
HR <sub>peak</sub>	147 ± 18	154 ± 15 (0.06)	139.6 ± 19	139 ± 20 (NS)	Haykowsky et al., 2009
	-	-	-	-	Hermann et al., 2011
	159 ± 14	163 ± 13 (< 0.05)	154 ± 15	153 ± 17 (NS)	Nytroen et al., 2012
VO <sub>2peak</sub>	21.2 ± 7.3	24.7 ± 8.8 (0.03)	18.2 ± 5.9	18.2 ± 5.3 (NS)	Haykowsky et al., 2009
	23.9 ± 6.7	28.3 ± 6.1 (< 0.001)	24.6 ± 5	23.4 ± 5.7 (NS)	Hermann et al., 2011
	27.7 ± 5.5	30.9 ± 5.3 (< 0.001)	28.5 ± 7	28 ± 6.7 (NS)	Nytroen et al., 2012
	4 ± 6.8	5.3 ± 4.9 (NS)	3.2 ± 4	3.9 ± 5.2 (NS)	Haykowsky et al., 2009
FMD	8.3 ± 1.3	11.4 ± 1.2 (0.01)	5.6 ± 1	5.3 ± 1.7 (NS)	Hermann et al., 2011

# Cambios en el VO<sub>2</sub> producidos por Cont vs HIIT

5

12

7

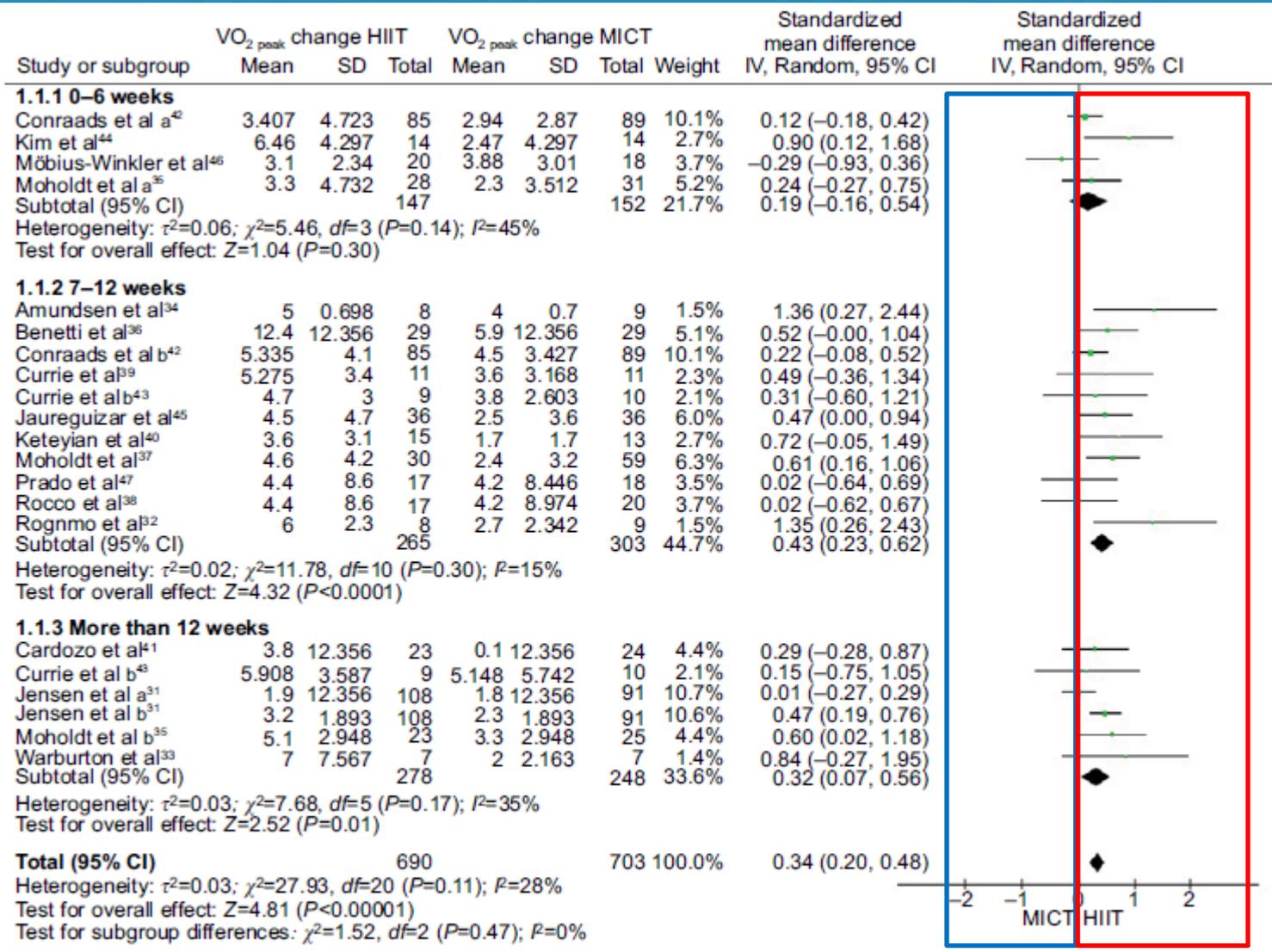


Figure 2 Forest plots depicting aerobic capacity changes as a result of HIIT versus MICT (standard mean difference in mL/kg/min).  
Abbreviations: HIIT, high-intensity interval training; MICT, moderate-intensity continuous training; IV, inverse variance; CI, confidence interval; SD, standard deviation.

# Escala Borg

Comodidad apreciada durante el entrenamiento

## RATING OF PERCEIVED EXERTION (RPE)

Borg's Scale (Gunner borg 1982):	Modified Borg Scale:
6-	0- at rest
7- very, very light	1- very easy
8-	2- somewhat easy
9- very light	3- moderate
10-	4- somewhat hard
11- fairly light	5- hard
12-	6-
13- somewhat hard	7- very hard
14-	8-
15- hard	9-
16-	10- very, very hard
17- very hard	
18-	
19- very, very hard	
20-	

# Recomendaciones para el entrenamiento de pacientes con enfermedades coronarias de acuerdo a su estatus funcional

**Table 1**

Progression models for aerobic exercise training—continuous aerobic exercise training (CAET) or high-intensity interval training (HIIT) – for patients with coronary heart disease (CHD) by functional status.

Patient profile	Stage of training	Prescription (weekly)	CAET	HIIT
Low functional status (< 5 METs)	Initiation (week 0–4)	2–3 × CAET	50–70% PPO (RPE: 11–15)	Not recommended
	Improvement (week 4–12)	2 × CAET and 1 × HIIT (SI)	50–70% PPO (RPE: 11–15)	HIIT-SI: 15 s to 1 min at 70–100% PPO (RPE: 15–18)
	Maintenance (week > 12)	2 × CAET and 1 × HIIT (SI+MI)	50–70% PPO (RPE: 11–15)	HIIT-MI: 1–3 min at 90–110% PPO (RPE > 15) HIIT-SI: 15 s to 1 min at 100–120% PPO (RPE: 15–18)
Normal and high functional status (≥ 5 METs)	Initiation (week 0–4)	2 × CAET and 1 × HIIT (SI)	50–70% PPO (RPE: 11–15)	HIIT-SI: 15 s to 1 min at 80–100% PPO (RPE: 15–18)
	Improvement (week 4–12)	1 × CAET and 2 × HIIT (SI+MI)	50–70% PPO (RPE: 11–15)	HIIT-MI: 1–3 min at 95–100% $VO_{2peak}$ (RPE > 15) HIIT-SI: 10 sec to 1 min at 100–120% $VO_{2peak}$ (RPE: 15–18)
	Maintenance (week > 12)	3 × CAET or HIIT (MI+LI)	50–70% PPO (RPE 14–16)	HIIT-MI: 1–3 min at 95–100% $VO_{2peak}$ (RPE > 15) HIIT-LI: 3–4 min at 80–85% $VO_{2peak}$ (RPE > 15)

HRR: heart rate reserve; PPO: peak power output; RPE: rate of perceived exertion; METS: metabolic equivalents; SI: short intervals; MI: medium intervals; LI: long intervals. HIIT proposal (SI, MI and LI) was based on references [27,29,31,37–52].

- long intervals: 3 to 15 min at 85% to 90%  $VO_{2peak}$  ;
- medium intervals: 1 to 3 min at 95% to 100%  $VO_{2peak}$  ;
- short intervals: 10 sec to 1 min at 100% to 120%  $VO_{2peak}$

# EXOESQUELÉTO MULTIARTICULAR DE RESISTENCIA AJUSTABLE PARA EJERCICIOS DE MUSCULACIÓN Y REHABILITACIÓN

Una alternativa novedosa para aumentar la seguridad de  
los entrenamientos con HIIT

# EXOESQUELETO MULTIARTICULAR DE RESISTENCIA AJUSTABLE PARA EJERCICIOS DE MUSCULACIÓN Y REHABILITACIÓN

