



FEDERACIÓN DE NATACIÓN
CASTILLA LA MANCHA



TECNOMED 2000
electromedicina

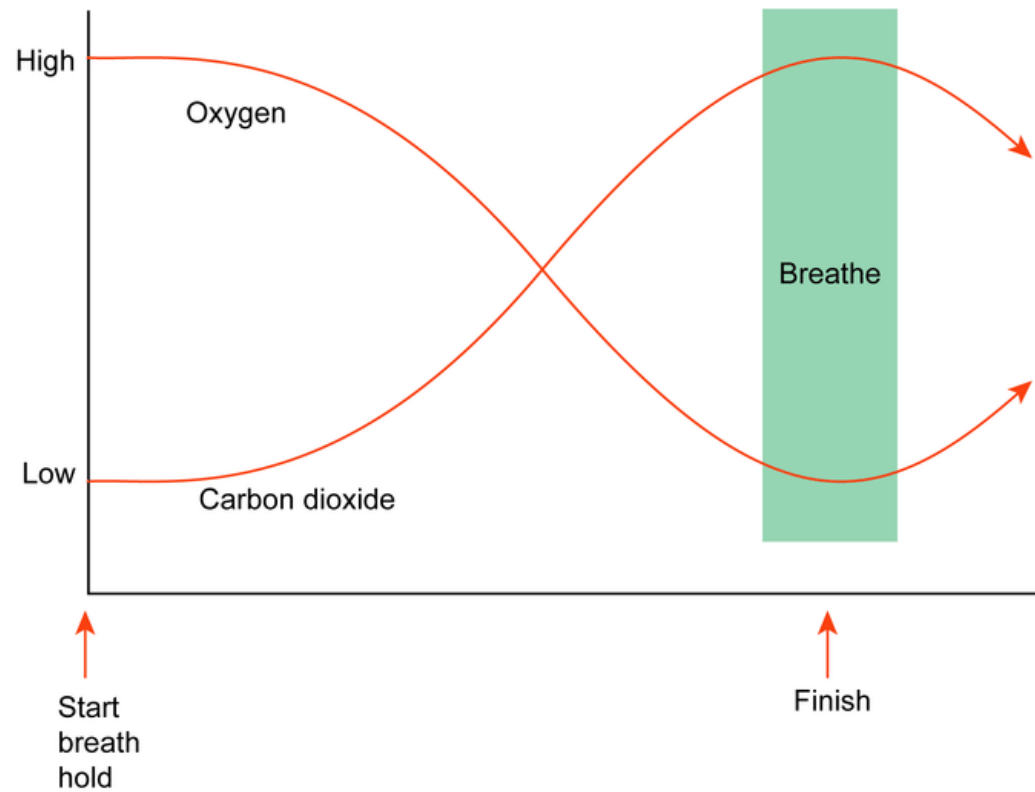
WWW.EUSWIM.EU

EUSWIM

Swimming performance

VIERNES 29 DE SEPTIEMBRE DE 2023
TOLEDO

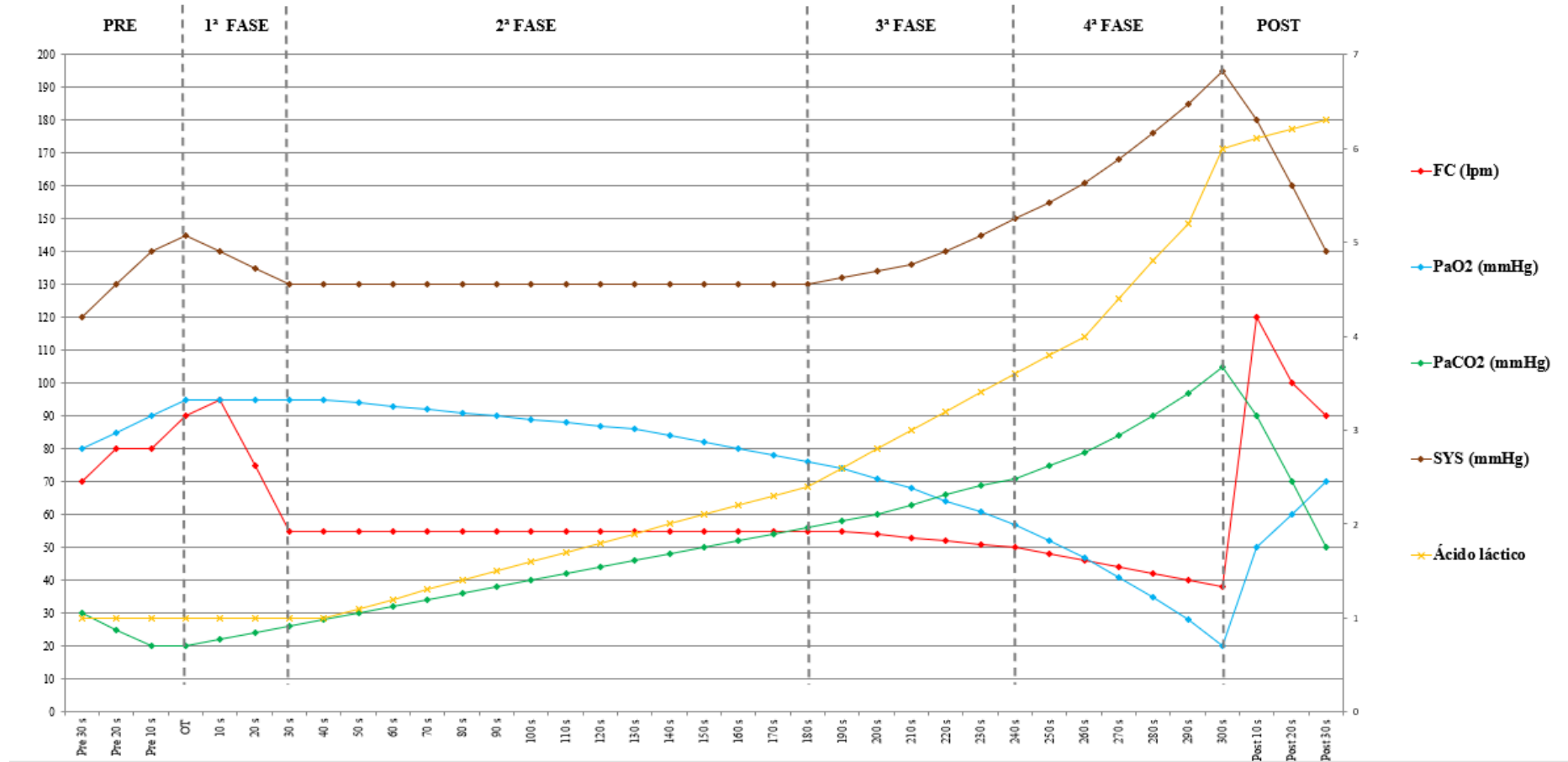
Francisco de Asís Fernández, PhD



Transferencia del entrenamiento en apnea sobre el rendimiento aeróbico y anaeróbico

Francisco de Asís Fernández, PhD.

Perfil metabólico de una apnea máxima



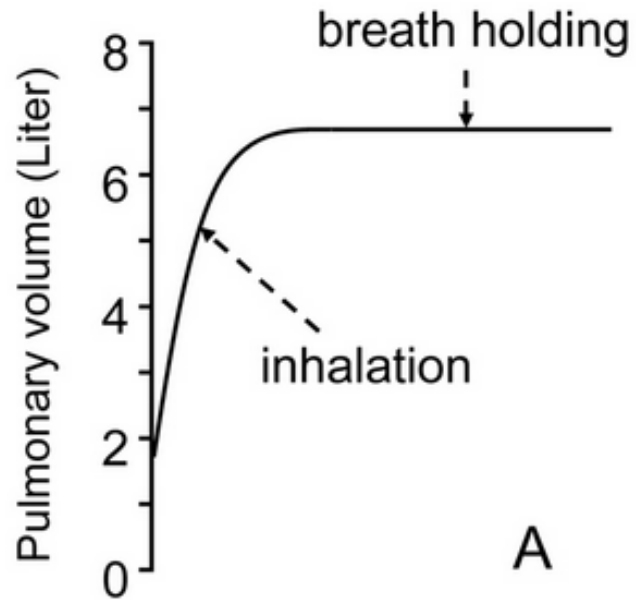
~~Apnea~~
~~máxima~~

Apneas
repetidas
(efecto residual)

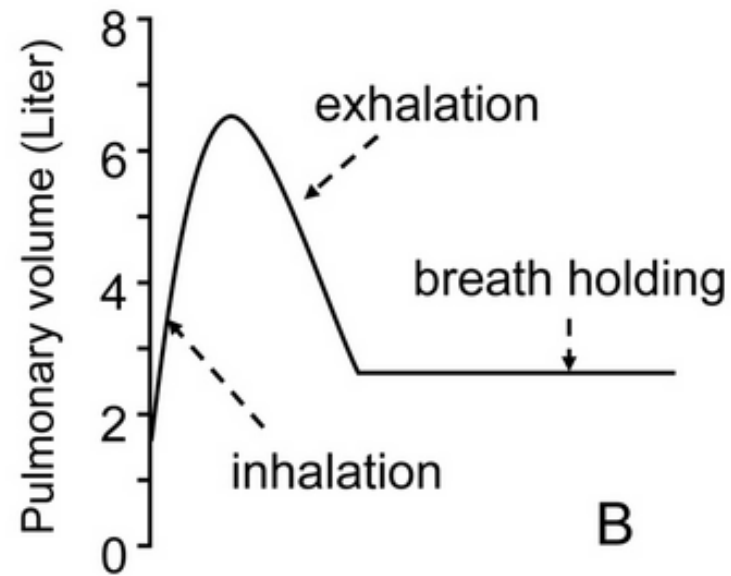
Ratio 15/10 en dinámico
Ratio 30/10 en reposo

Ratio > es difícil de mantener
<10 s descanso baja la respuesta cardiaca

Apneas a bajo volumen pulmonar

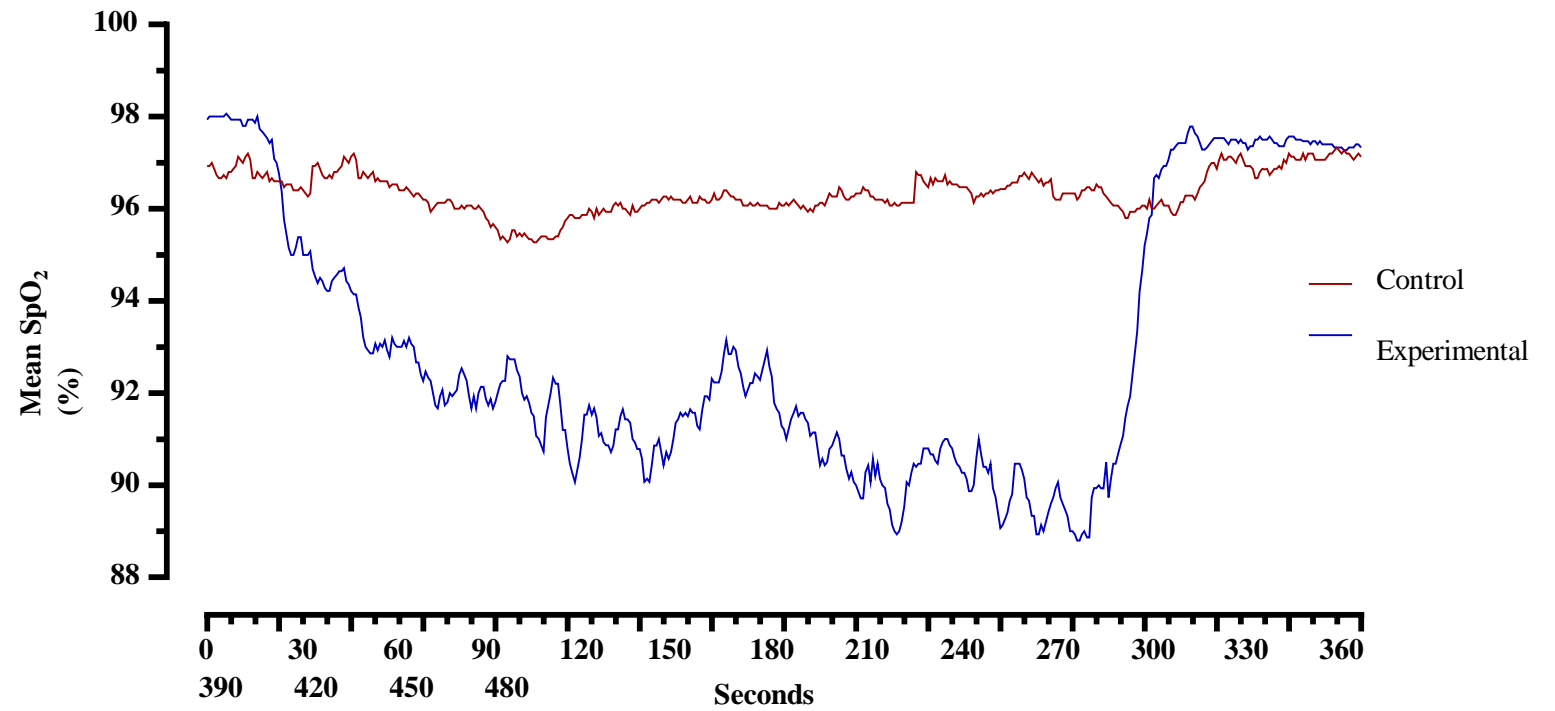


Hypoventilation at high pulmonary volume (inhale-hold)



Hypoventilation at low pulmonary volume (exhale-hold)

Hipoxemia e Hipercapnia



↓ Aeróbico ↑ Anaeróbico

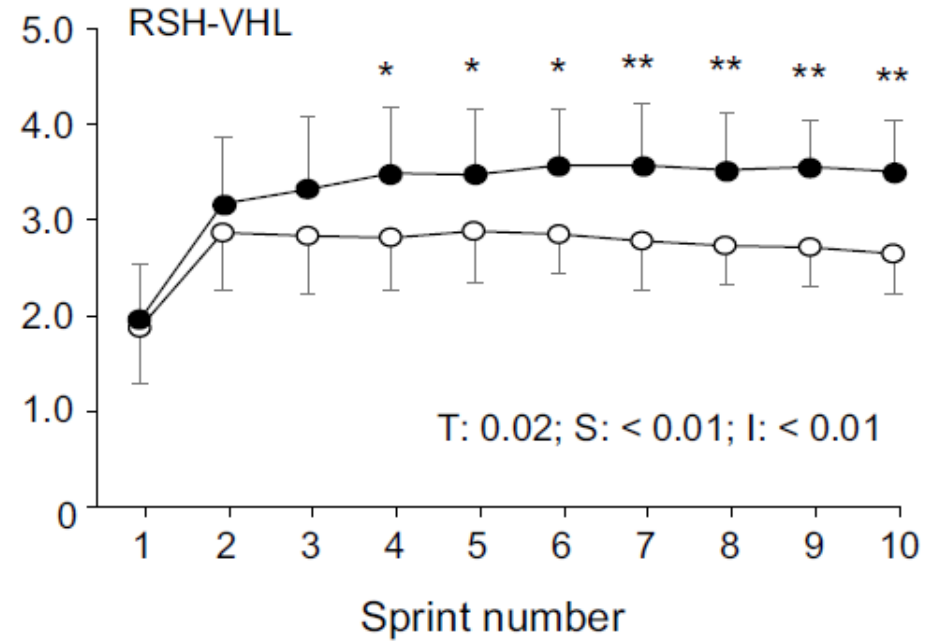
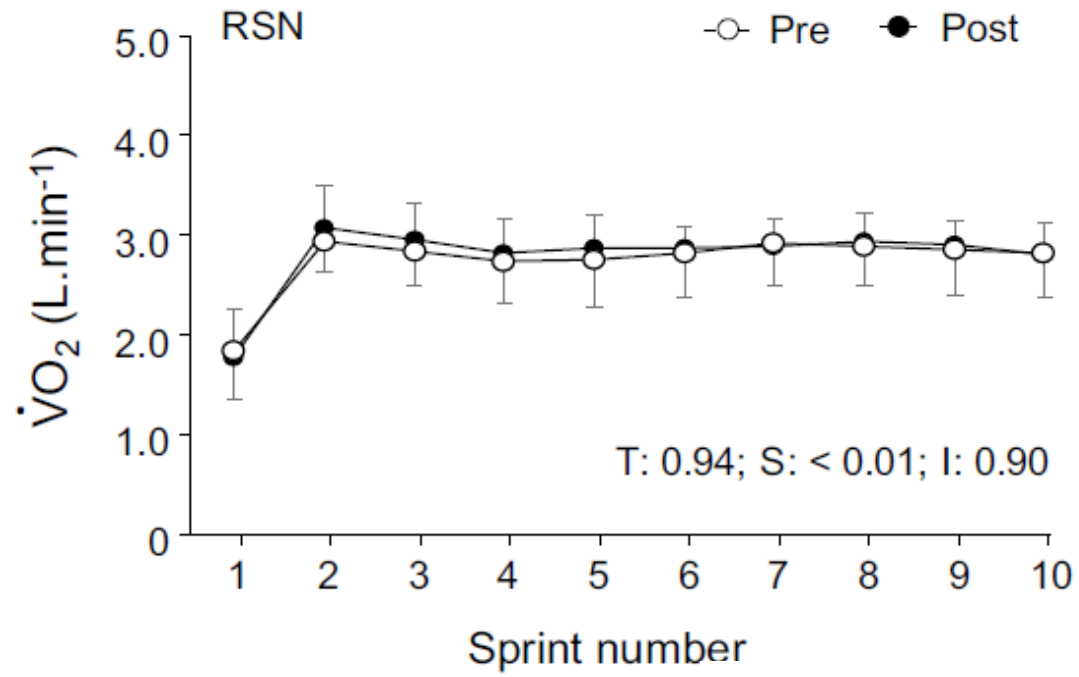
Hipoxemia

Table I. Time spent at different levels of SpO₂ during a training session including two sets of 8 × 40 m sprints.

Range of SpO ₂	Time (s)		Time (%)	
	RSH-VHL	RSN	RSH-VHL	RSN
>96%	5.9 ± 9.5	126.0 ± 78.6 [†]	1.3 ± 2.1	28.6 ± 17.9 [†]
[93–96%]	108.6 ± 67.7	302.8 ± 68.2 [†]	24.7 ± 15.4	68.8 ± 15.5 [†]
[89–92%]	169.4 ± 88.0	11.2 ± 16.4 [†]	38.5 ± 20.0	2.5 ± 3.7 [†]
[85–88%]	138.1 ± 82.5	0.0 ± 0.0 [†]	31.4 ± 18.8	0.0 ± 0.0 [†]
<85%	18.0 ± 24.5	0.0 ± 0.0 [†]	4.1 ± 5.6	0.0 ± 0.0 [†]
Total	440	440	100	100

Note: Values are mean ± SD.

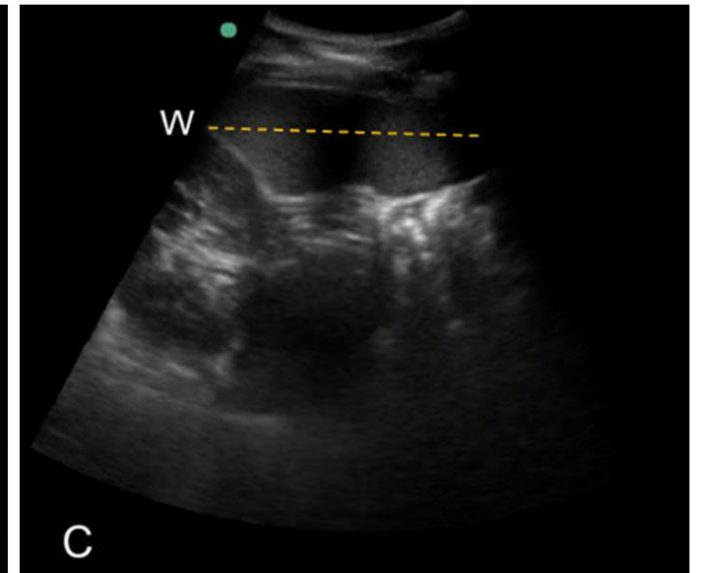
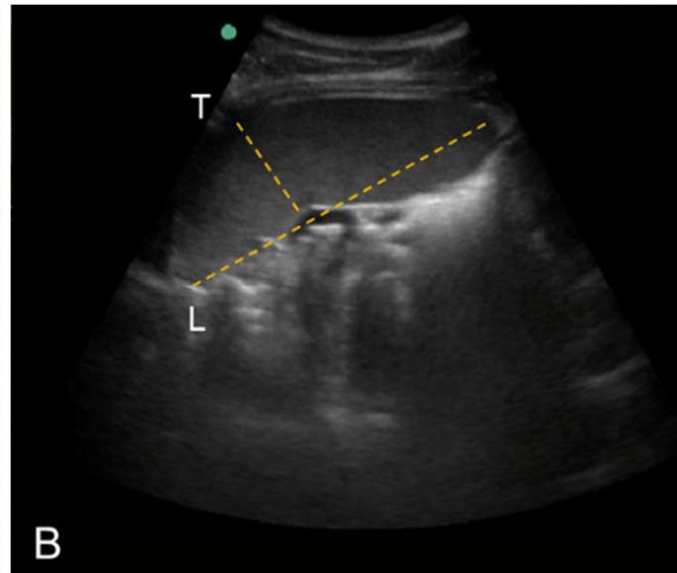
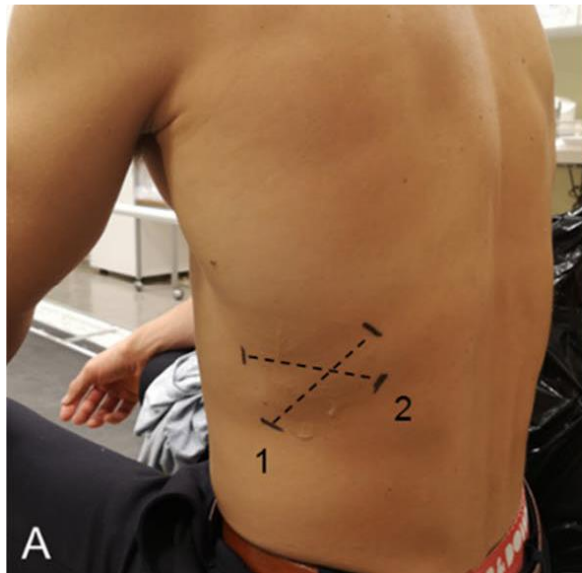
SpO₂, arterial oxygen saturation; RSH-VHL, repeated-sprint exercise with voluntary hypoventilation at low lung volume; RSN, repeated-sprint exercise with normal breathing. [†]*p* < .05 for difference with RSN.



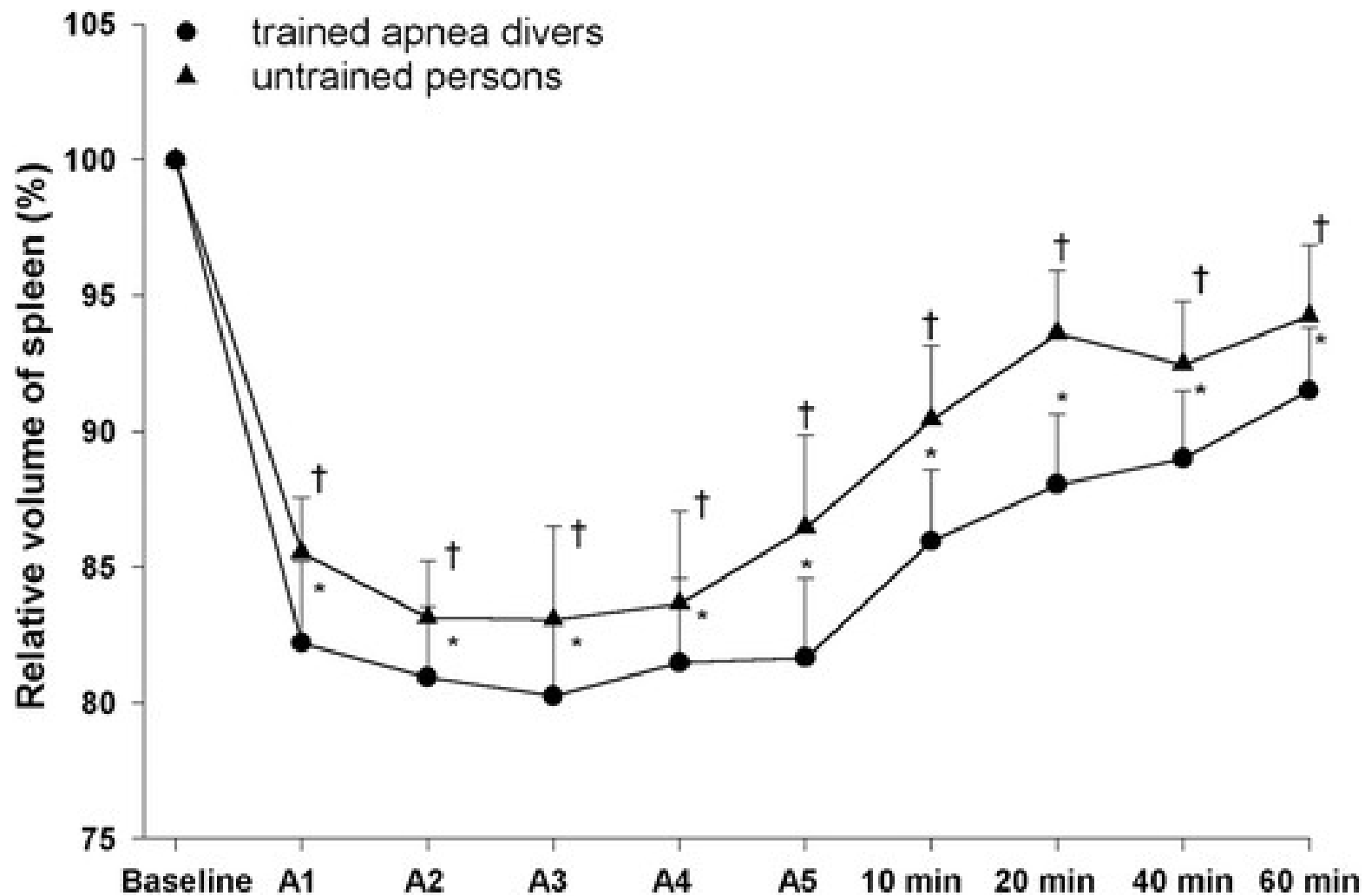
Contracción esplénica

↑ Volumen ↑ Contracción = ↑ 50 % su aporte

Bazo 70-80% Hematocrito



Contracción esplénica

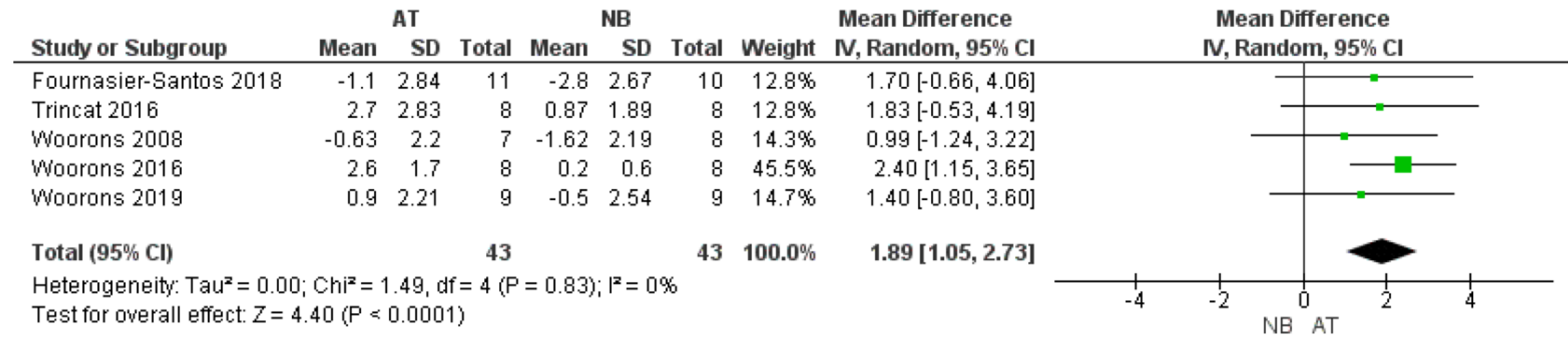


CONTROL: CPT 5.5 L			APNEISTA: CPT 11 L	
ml de O₂	% O₂		% O₂	ml de O₂
1,996 ml	100 %	TOTAL	100 %	3,200 ml
820 ml	41 %	Pulmones	51.5 %	1,650 ml
880 ml	44 %	Hemoglobina	34.4 %	1,100 ml
240 ml	12 %	Mioglobina	7.5 %	240 ml
56 ml	2.8 %	Tejidos	1.9 %	60 ml
100 ml	+ 5 %	Bazo	+ 4.7 %	150 ml
2096ml		Total + Bazo		3350 ml

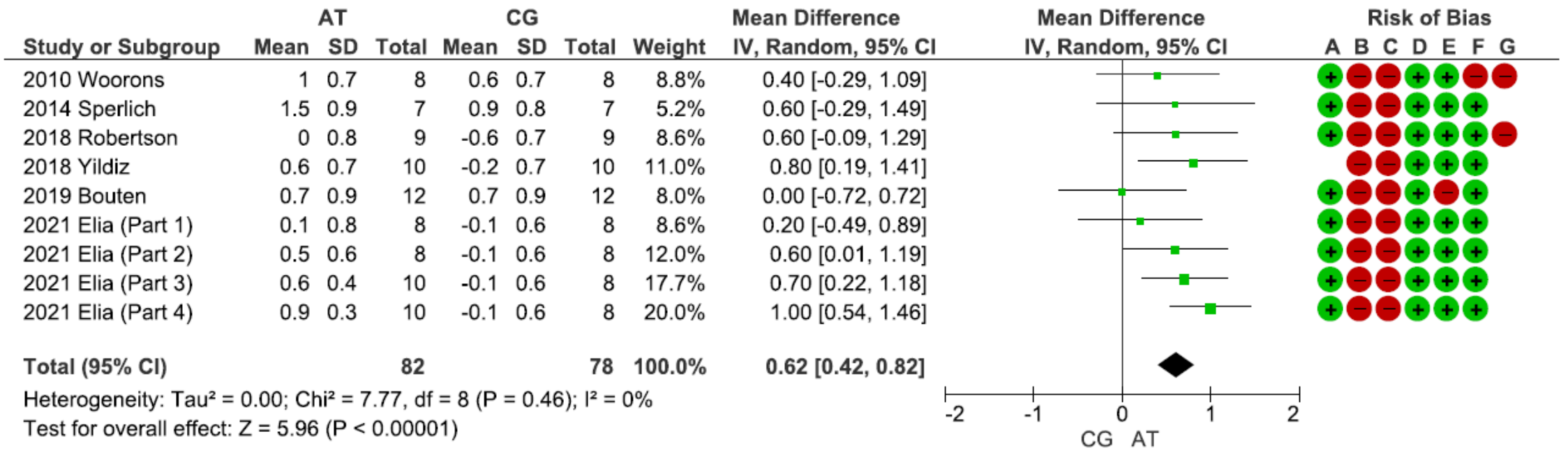
Schagatay 2009

Reservas de O2 (...y CO2)

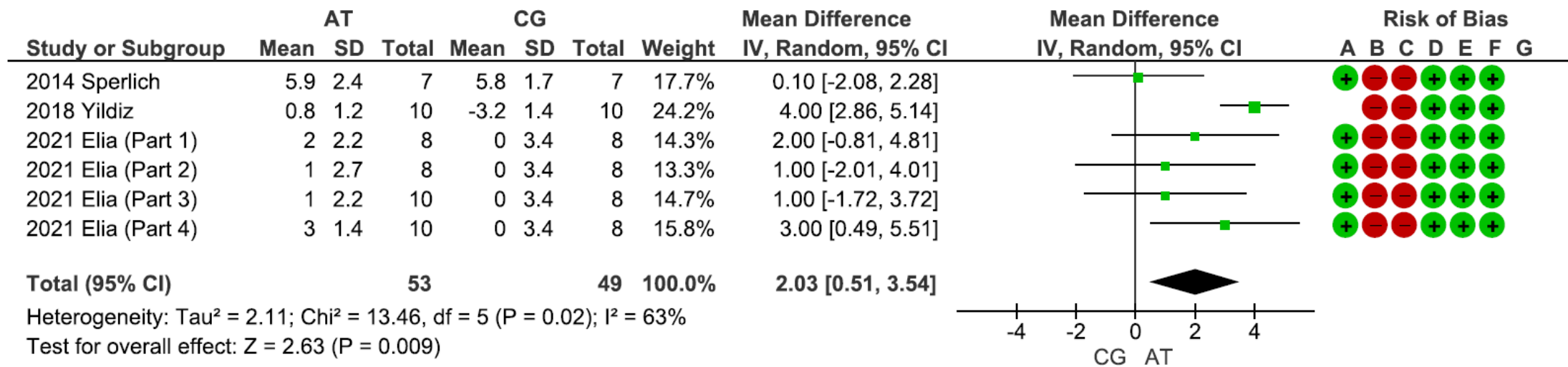
(a) Forest plot of $[La]_{peak}$



Tolerancia al lactato

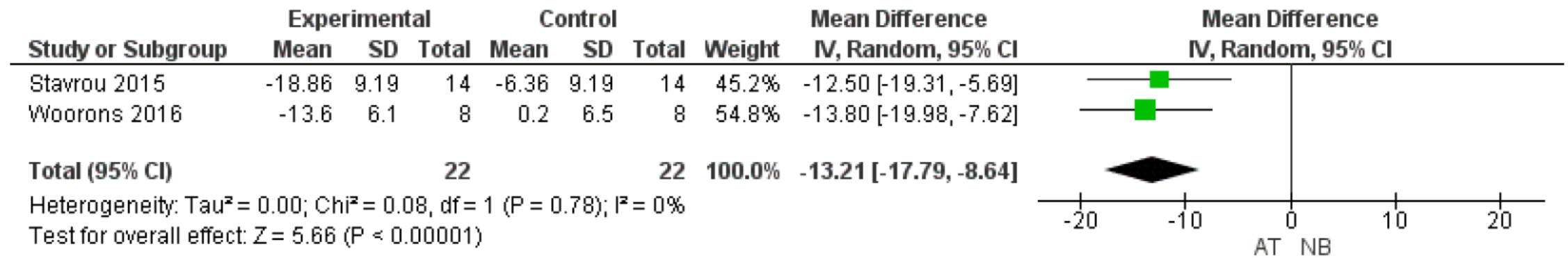


Hemoglobina (Efecto agudo)



Hematocrito (Efecto agudo)

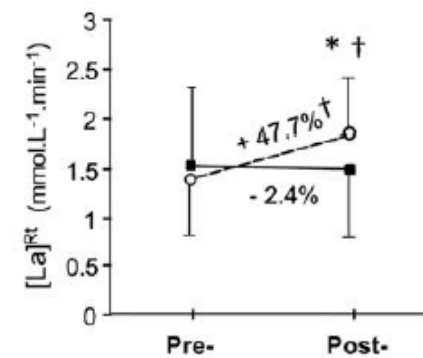
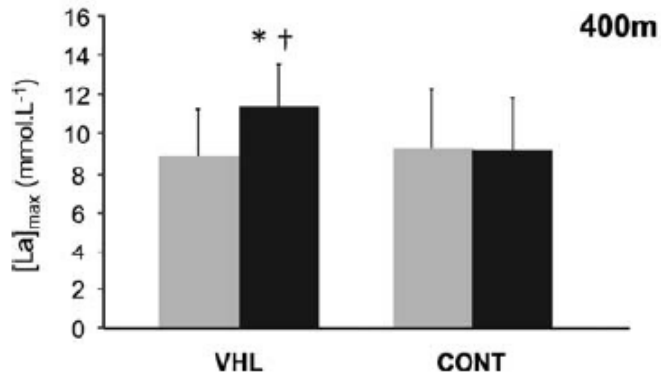
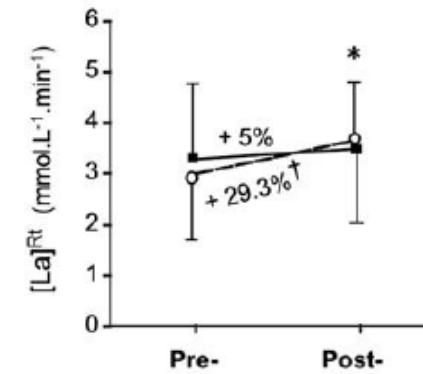
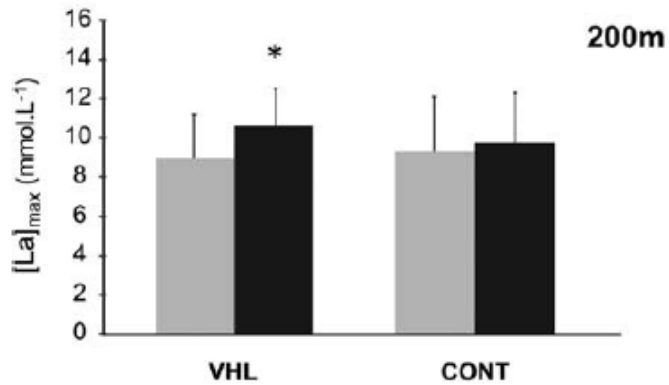
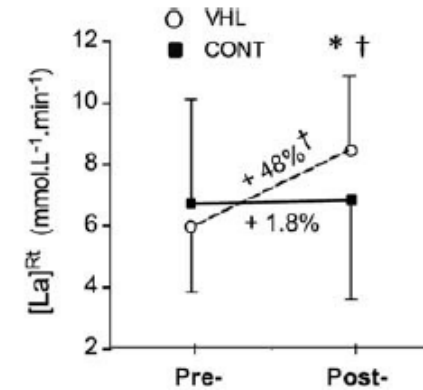
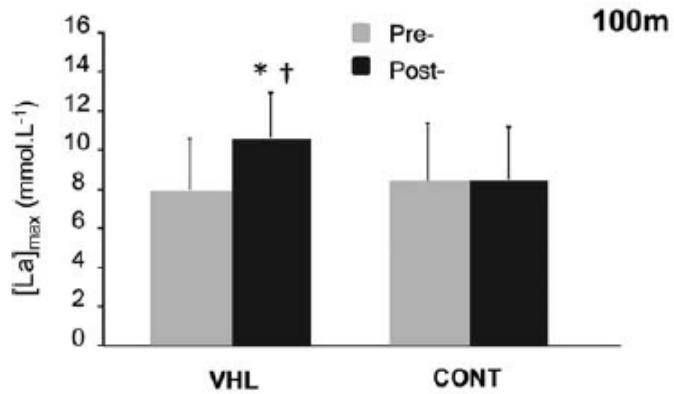
(g) Forest plot of TT_{400swim}



Rendimiento en 400m swim

Rendimiento

Tolerancia acidosis





FEDERACIÓN DE NATACIÓN
CASTILLA LA MANCHA



TECNOMED 2000
electromedicina

WWW.EUSWIM.EU

EUSWIM

Swimming performance

VIERNES 29 DE SEPTIEMBRE DE 2023
TOLEDO

Francisco de Asís Fernández, PhD