HOSPITAL NACIONAL DE PARAPLÉJICOS Toledo

Biomechanics and Technical Aids Department

Assessment of Fatigue in Athletes During Manual Wheelchair Propulsion

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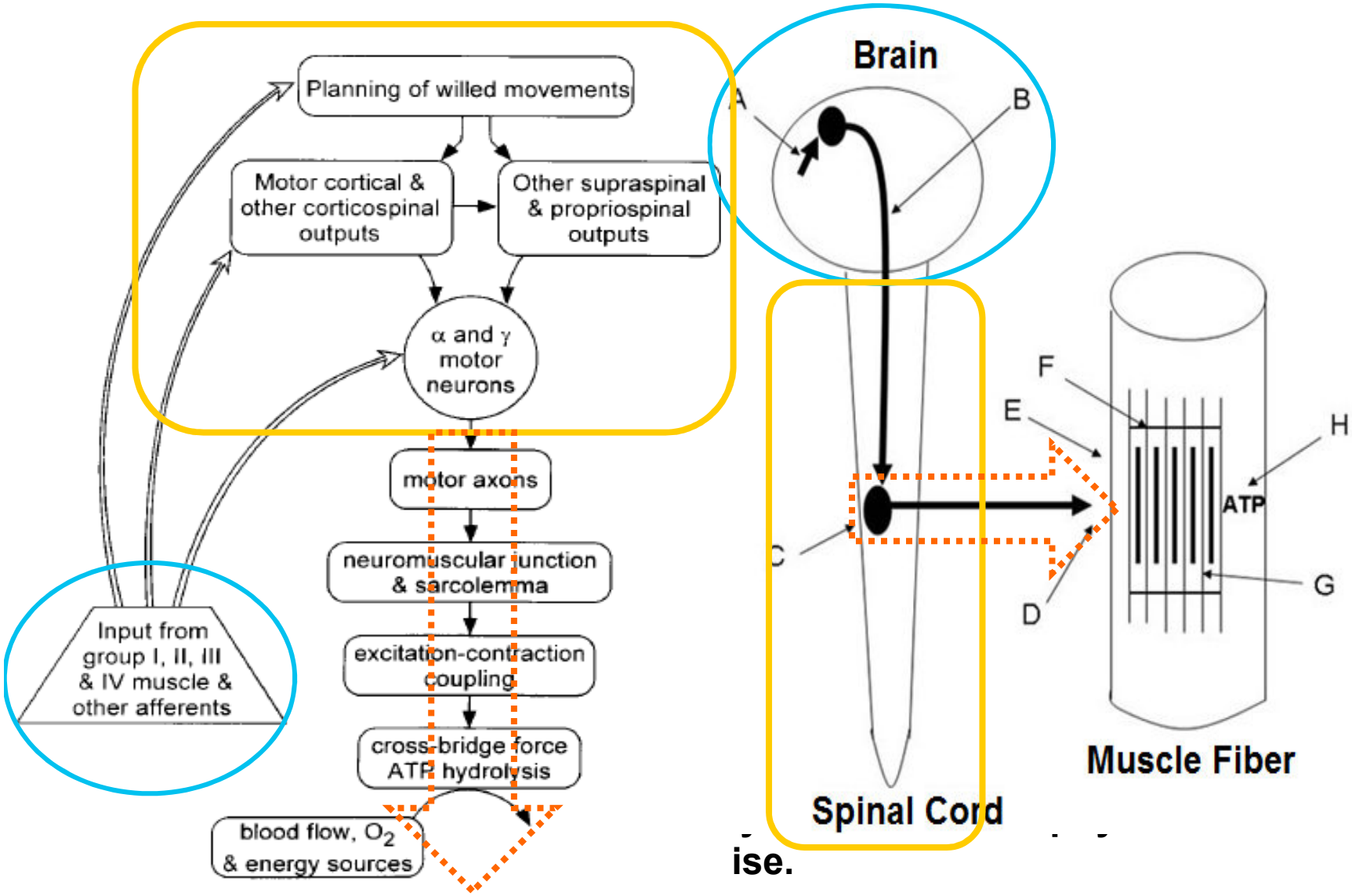
VISTA CONFERENCE

European Research Group in Disability Sports (ERGiDS)

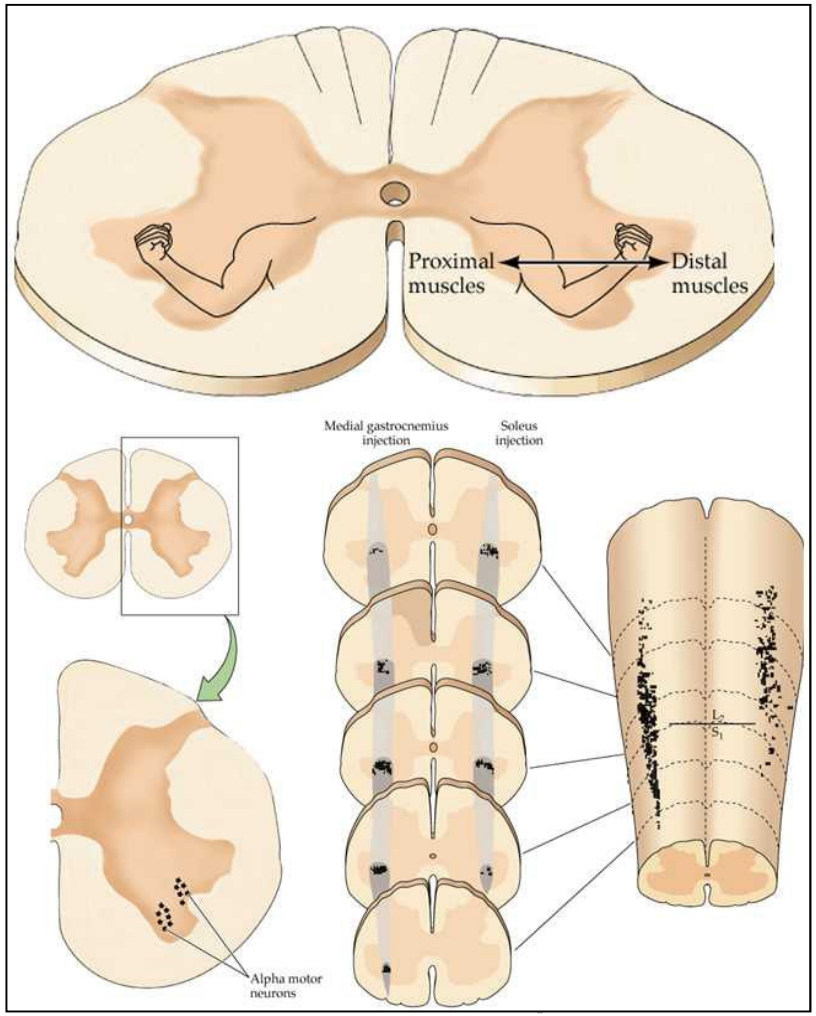
FATIGUE vs SPINAL CORD INJURY



ise.

Bigland-Ritchie B. et al. (1983); Edwards (1981); Gandevia (1986); Mass (2001904)

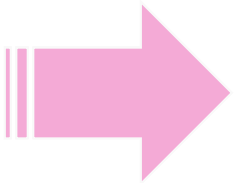
FATIGUE vs SPINAL CORD INJURY

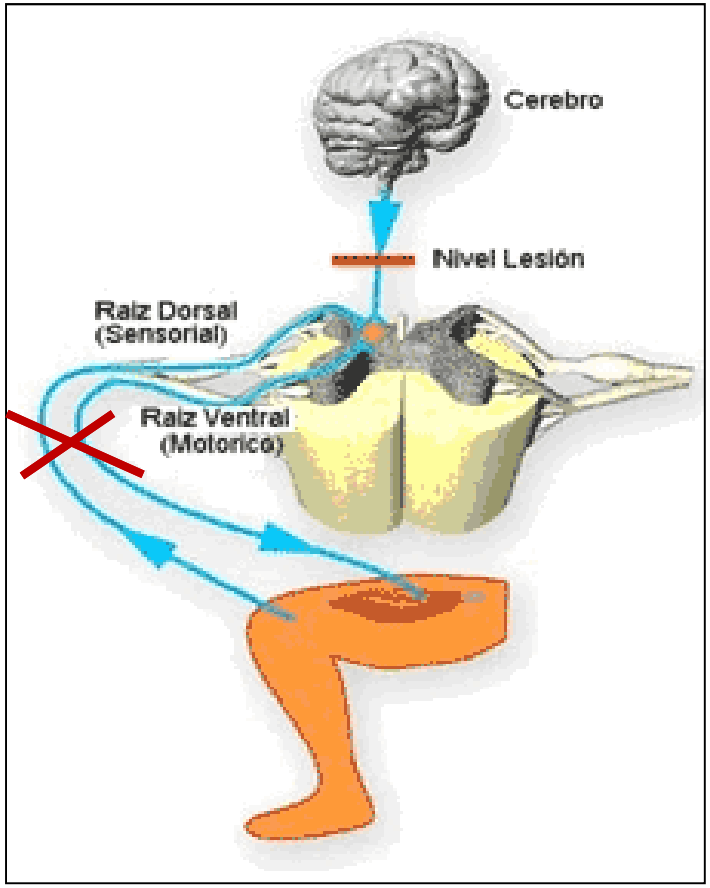


Inside the Spinal Cord is where the output of the brain is ordered to stimulate the muscle with how and when it has to move giving us what we know as a coordinated movement.

Staas WE et al. (1998); Sapru HN (2002); Steeves JD (2007); Alcobendas Maestro M (2010)

FATIGUE vs SPINAL CORD INJURY

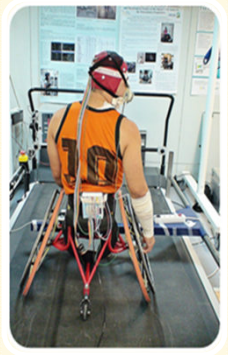




Assessment of Fatigue in Athletes During Manual Wheelchair Propulsion

Hyphotesis 1

In trained people with spinal cord injury (SCI) the behaviour of the mechanisms where fatigue is developed they are unchained in a different way than a controled group (CG) of trained athletes.



Hyphotesis 2

The people that have SCI that have been trained will get tired a lot later in the proposed exercise than a CG of trained athletes, without the importance of the SCI that they suffer.

03. THE MAIN OBJECTIVE

Assessment of Fatigue in Athletes During Manual Wheelchair Propulsion

To study the behavior of the mechanisms of development of fatigue during manual wheelchair propulsion in athletes with SCI.

To compare the physiological, metabolic and biomechanical aspects

Study 1: Study of Fatigue during a Short –Term Test

Study 2: Study of Fatigue during a Long-Term Test

04. PARTICIPANTS. INCLUSION CRITERIAS

Athletes with Spinal Cord Injury (SCI)

- ✓ Athletes with lower than the T6 SCI level.
- ✓ Ages from 18 to 45 years old.
- ✓ Aerobic training 3-6 h/ week.
- ✓ Daily life dependent on the use of the wheelchair.
- ✓ To have at least 6 months of injury evolution.

Control Group (CG)

- ✓ Athletes without sensori-motors alterations.
- ✓ Ages from 18 to 45 years old.
- ✓ Aerobic training 3-6 h/ week

▪ ***Study 2. Long-Tem Fatigue Test***

It was established that they had aerobic training at least 6h/week to be equal to the sample of elite athletes with SCI.

Ross RM & Jackson AS (1990); Freed M. (1991); Pérez J. (2003)

Study 1 and Study 2

- **Illness or injury** at the moment of doing the test.
- Participants with **cardiovascular disease** or which had suffered **hyperthermia or hypothermia** in the last 48h.
- Those who indicated shoulder pain or history of **trauma the last 4 weeks**.
- Was also excluded any subject who refused to sign the consent form.

Study 2

- Participants who showed **poor adaptation** to exercise on wheelchair during **Study 1**.
- Those not meeting the inclusion criteria specific to the CG for the realization of Study 2.

Study 1: Short-term Fatigue Test

Subject	Age	Weight (kg)	Aerobic Training (h/week)
Mean SCI ± SD (n=9)	30 ± 8	63 ± 10	8 ± 2
Mean CG ± SD (n=9)	29 ± 6	77 ± 8	6 ± 2

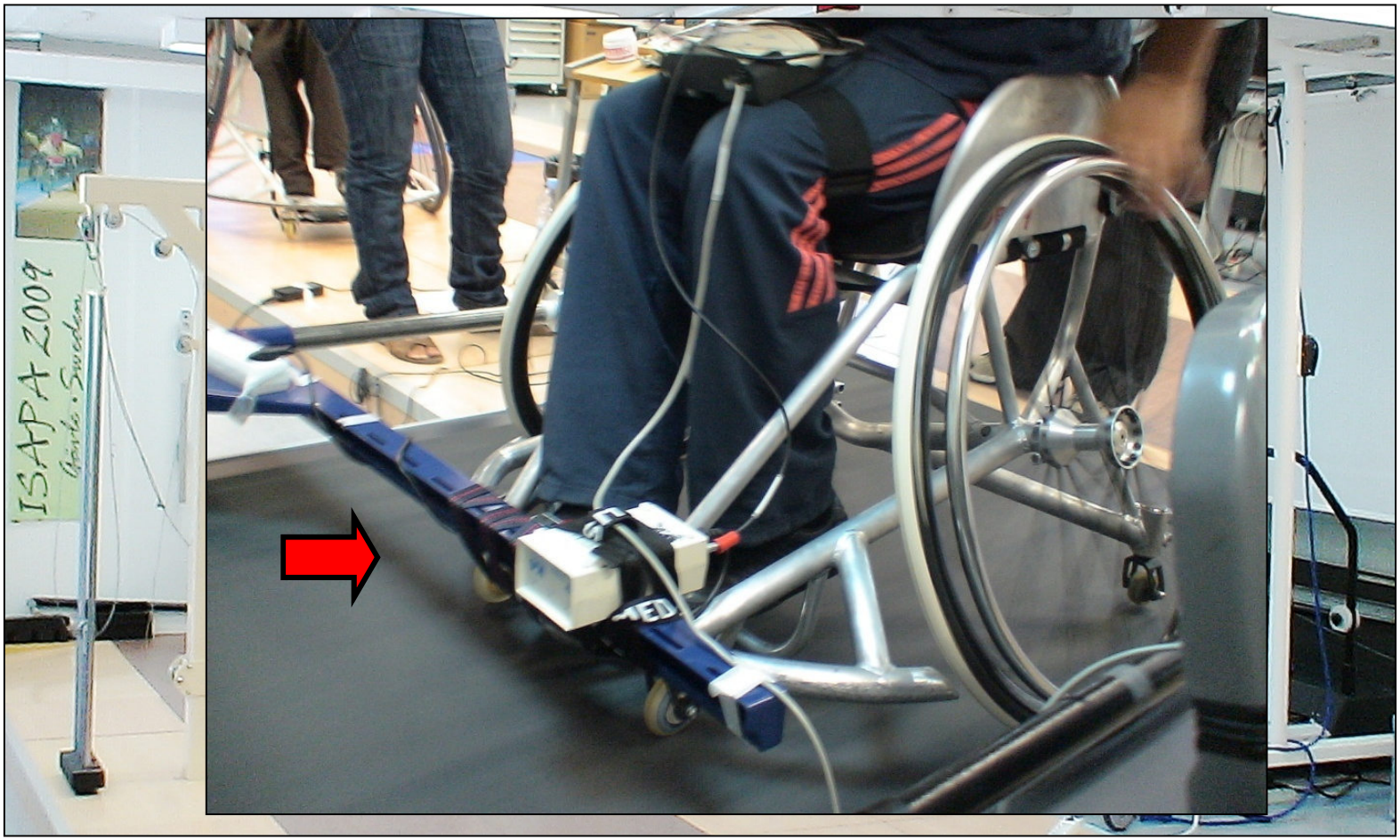
Study 2: Long-term Fatigue Test

Subject	Age	Weight (kg)	Aerobic training (h/week)
Mean SCI ±SD (n=5)	28,6 ± 2	63,2 ± 12	> 8
Mean CG ±SD (n=5)	27 ± 4	76,8 ± 7	> 8

Descriptive Statistic (Mean+/- Standart Deviation (SD)

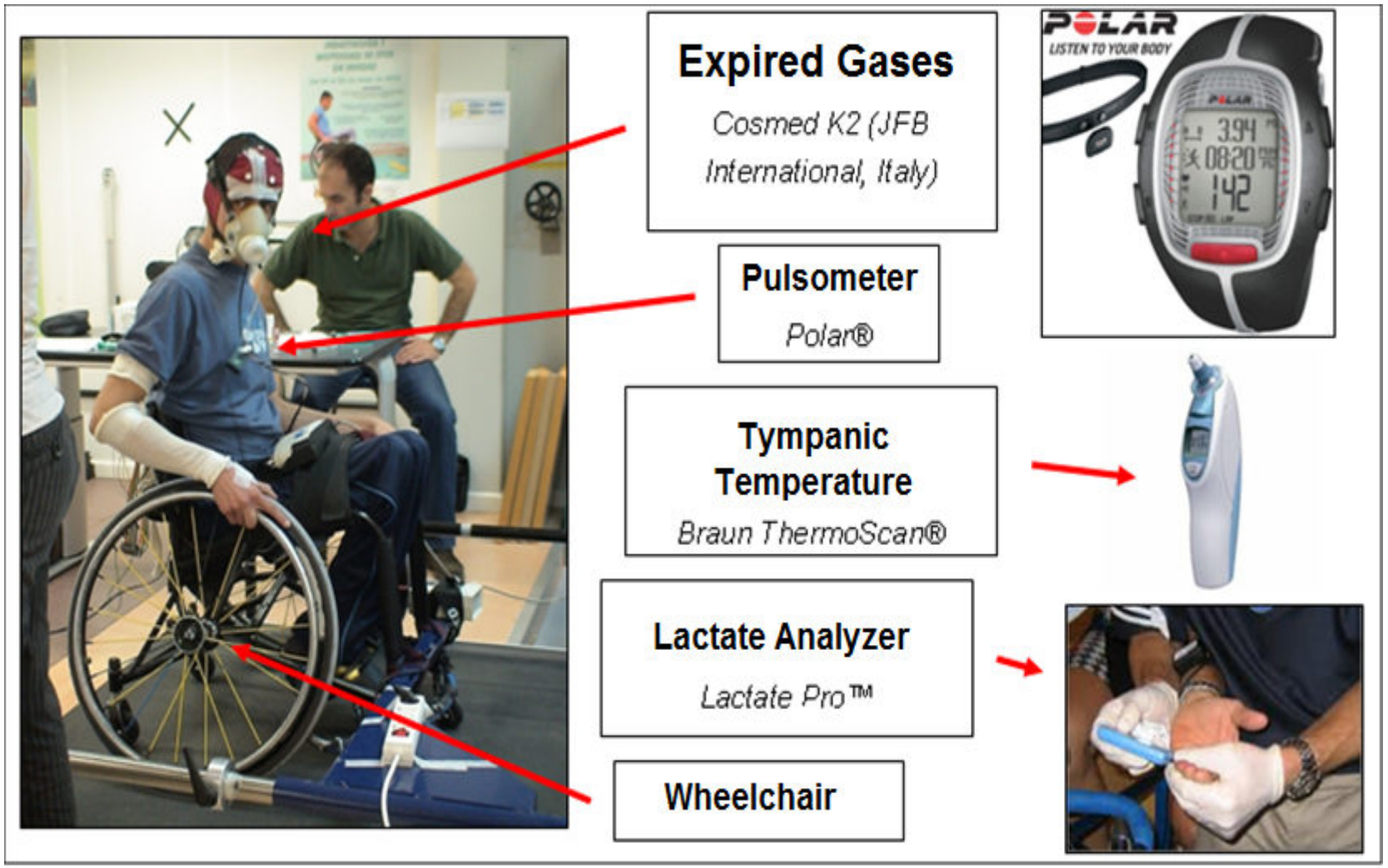
Assessment of Fatigue in Athletes During Manual Wheelchair Propulsion

Laboratory Setting. Wheelchair Treadmill.



Solís-Mozos M; Crespo-Ruiz B; Gil-Agudo A y Del Ama-Espinosa A. (2009); Crespo-Ruiz B: European Congress of Adapted Physical Activity, Torino, Oct. (2008)

Assessment of Fatigue in Athletes During Manual Wheelchair Propulsion



Crespo-Ruiz B (2008); Solís-Mozos et al. (2009)

Study 1: Maximal Incremental Aerobic Test

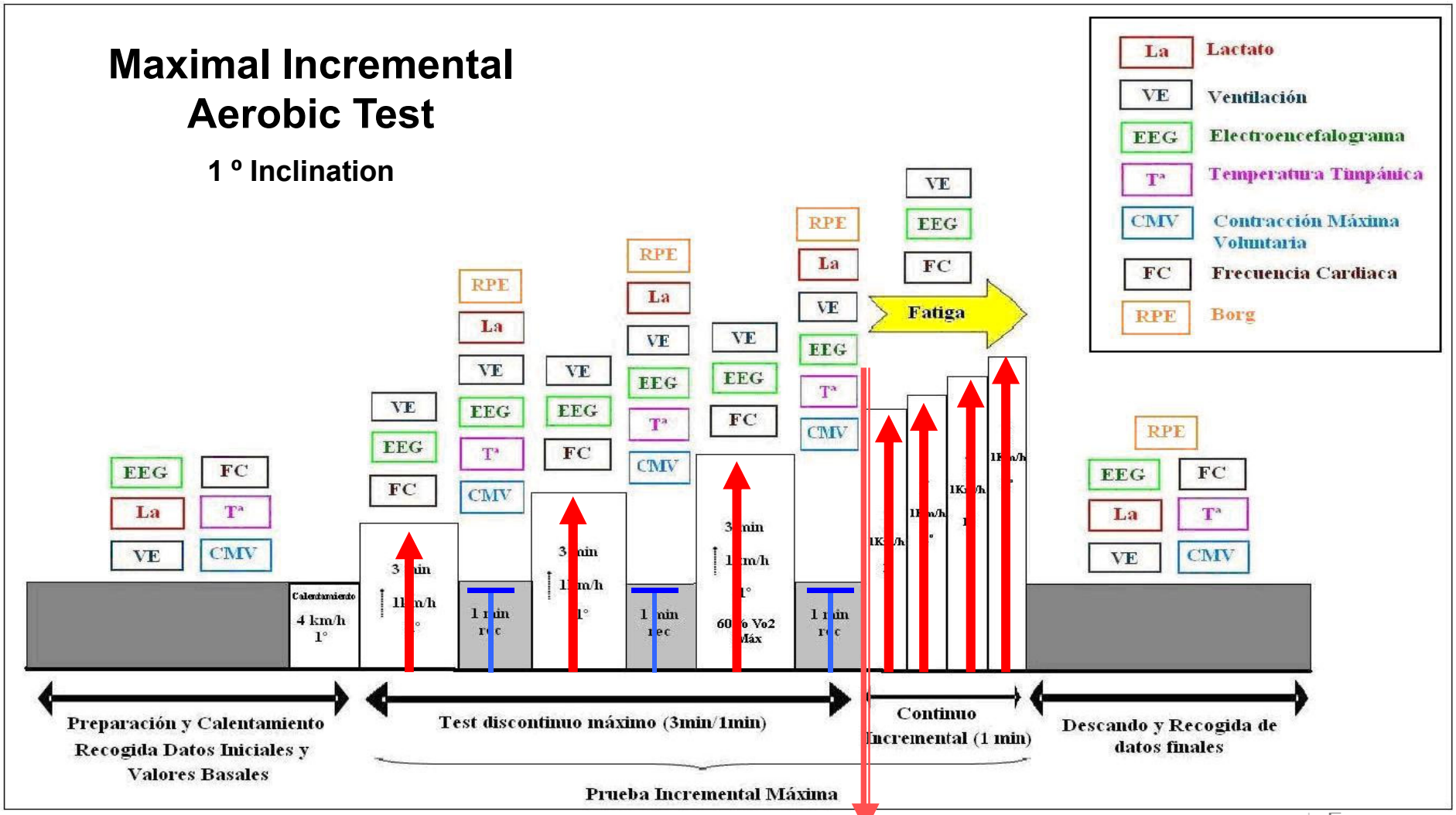
(Short-term Test)

Study 2: Anaerobic Threshold Test

(Long-Term Test) (75 min max)

Methodology: Aguado-Jiménez R, Crespo-Ruiz B, De los Reyes-Aguilar J, Gil-Agudo A, Oliviero A, Mordillo L: ACSM's 59th Annual Meeting and 3rd World Congress on Exercise is Medicine, San Francisco (California), 2012

Study 1: Study of Fatigue during short-term test



Jones A et al. (1996); Cálculo UA: Coyle et al. (1983);
Criterios Test Máximo: ACSM (2006)

AT : 6 km· h^{-1}

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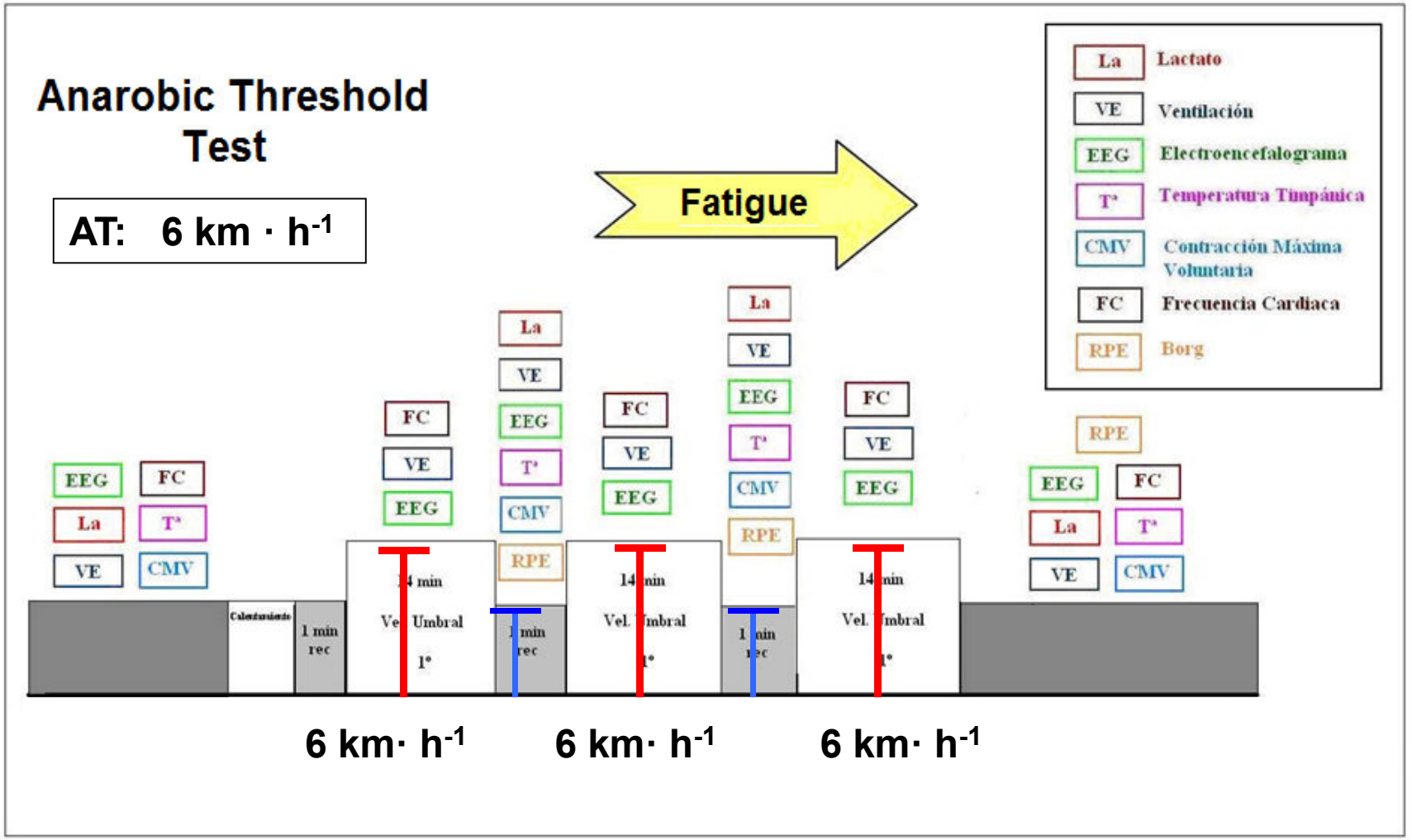

Billat V et al. (1996) a 1 º Inclination on a Treadmill

06. METHOD

Assessment of Fatigue in Athletes During Manual Wheelchair Propulsion

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Cardiorespiratory Parameters

Oxygen consumption **(VO2)** absolute (l / min) and relative (ml · kg-1 · min-1).
CO2 production **(VCO2)** (l / min)
Respiratory exchange ratio (**RER** = VCO2 / VO2).
CO2 Ventilatory equivalent **(VE/VCO2).**
Basal heart rate **(Fcbasal)** (beats / min) and maximum (HRmax) (beats / min).

Metabolic Parameters

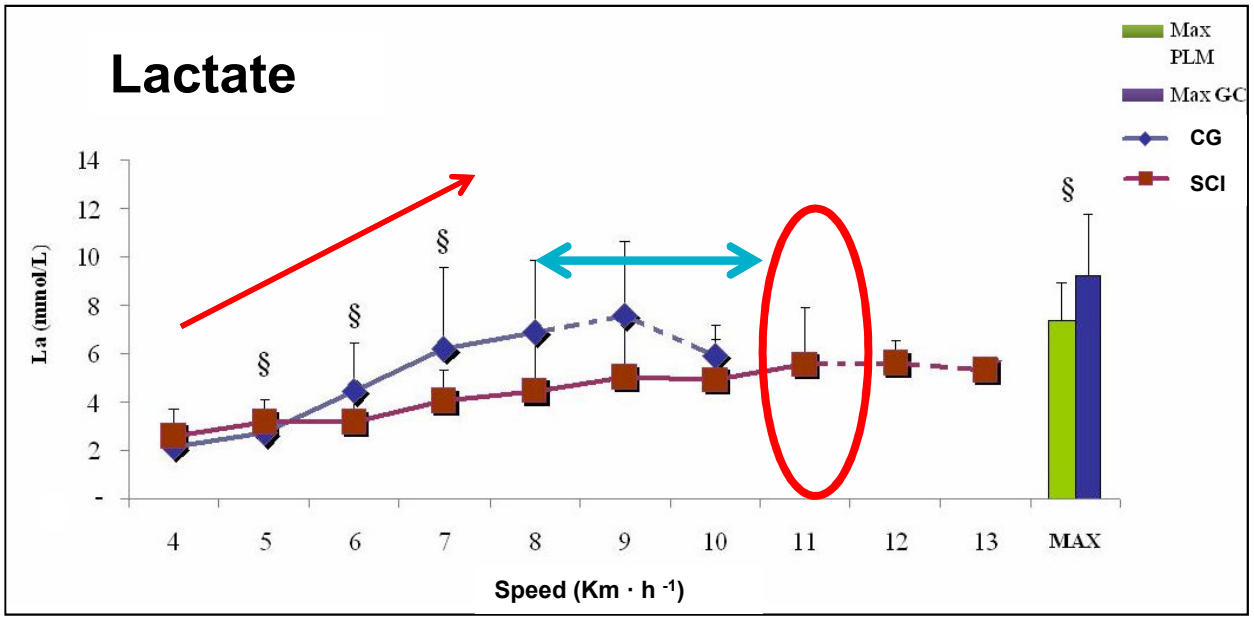
Blood Lactate **(La)** (mmol)

Tympanic Temperature

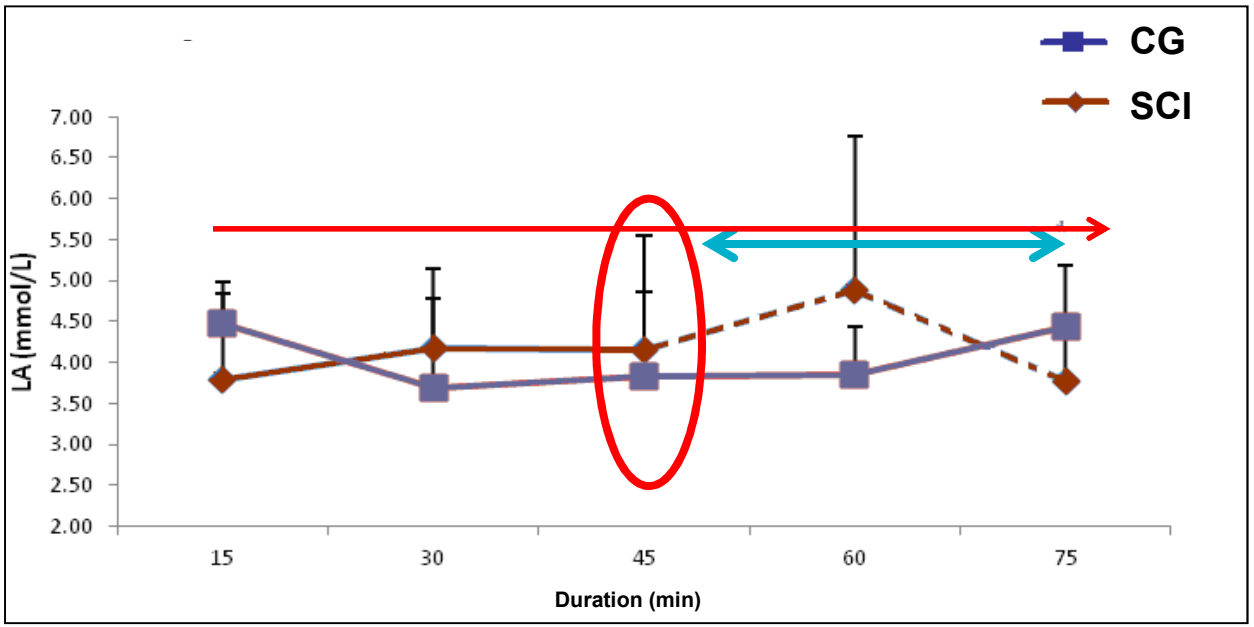
(Temp.) (Cº)

RPE (6-20)

% Gross Mechanical Efficiency (GME)

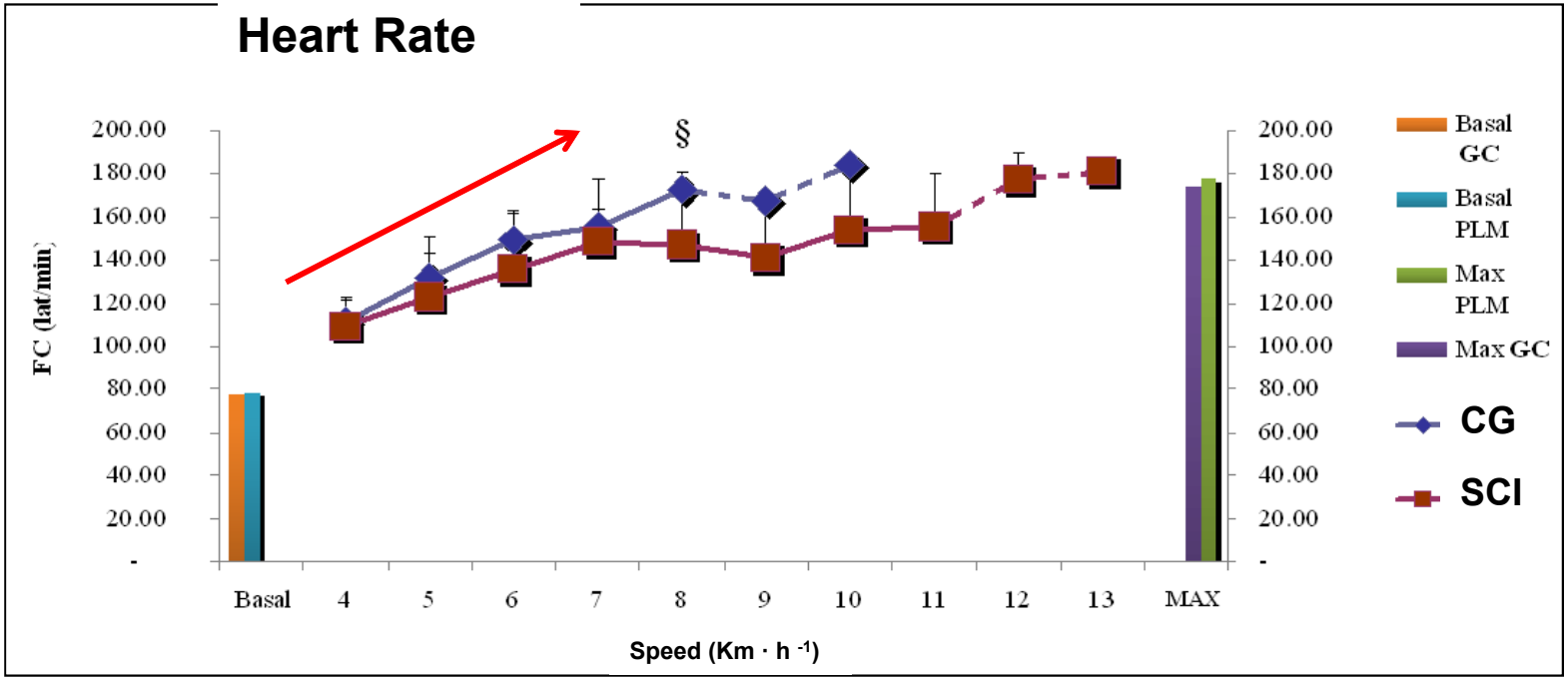


INCREMENTAL TEST

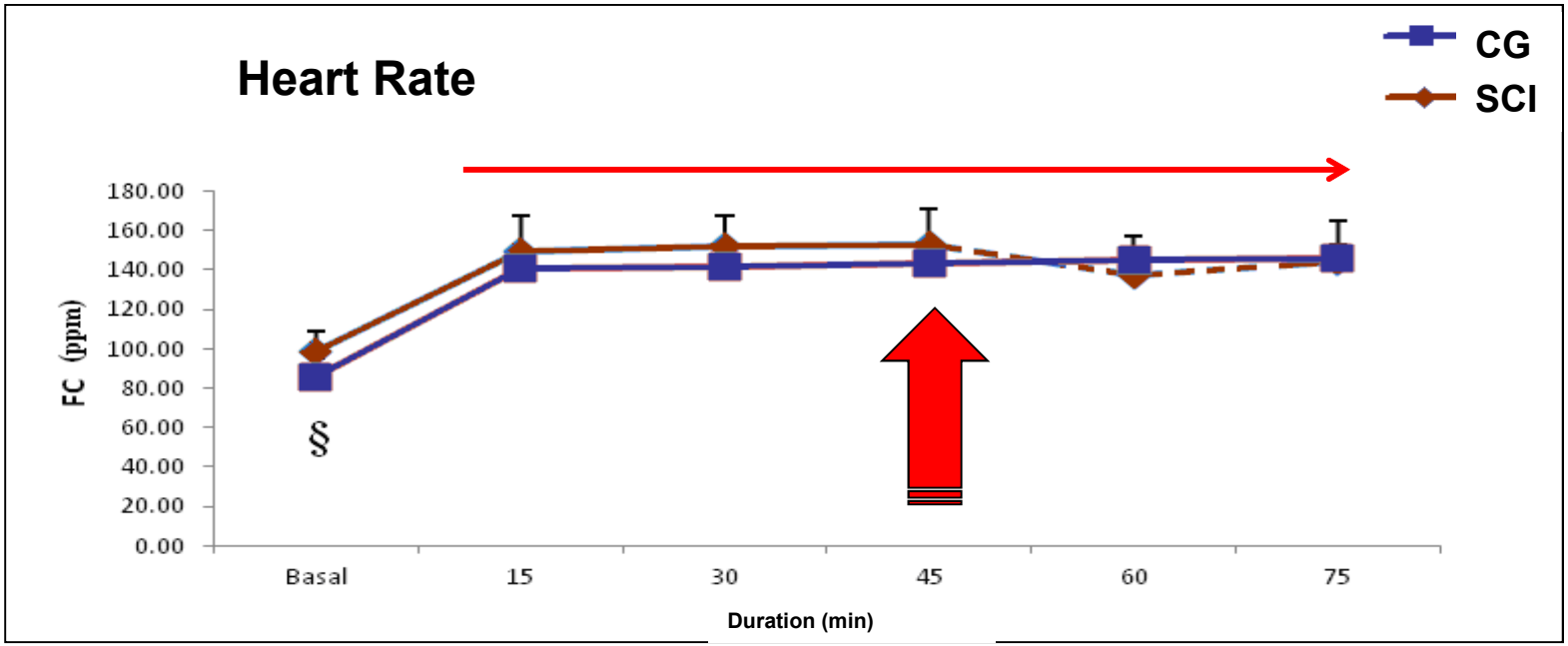


ANAEROBIC THRESHOLD (AT) TEST

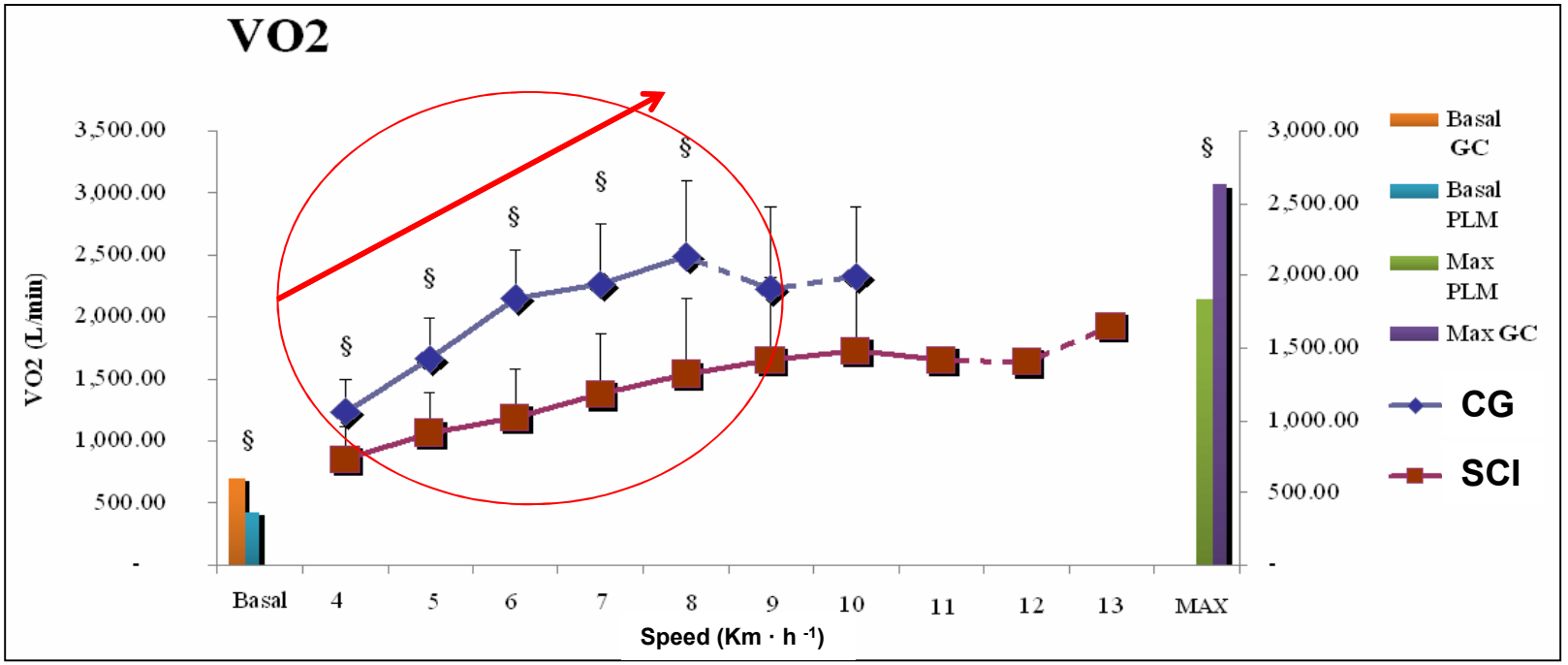
INCREMENTAL TEST



AT TEST



INCREMENTAL TEST



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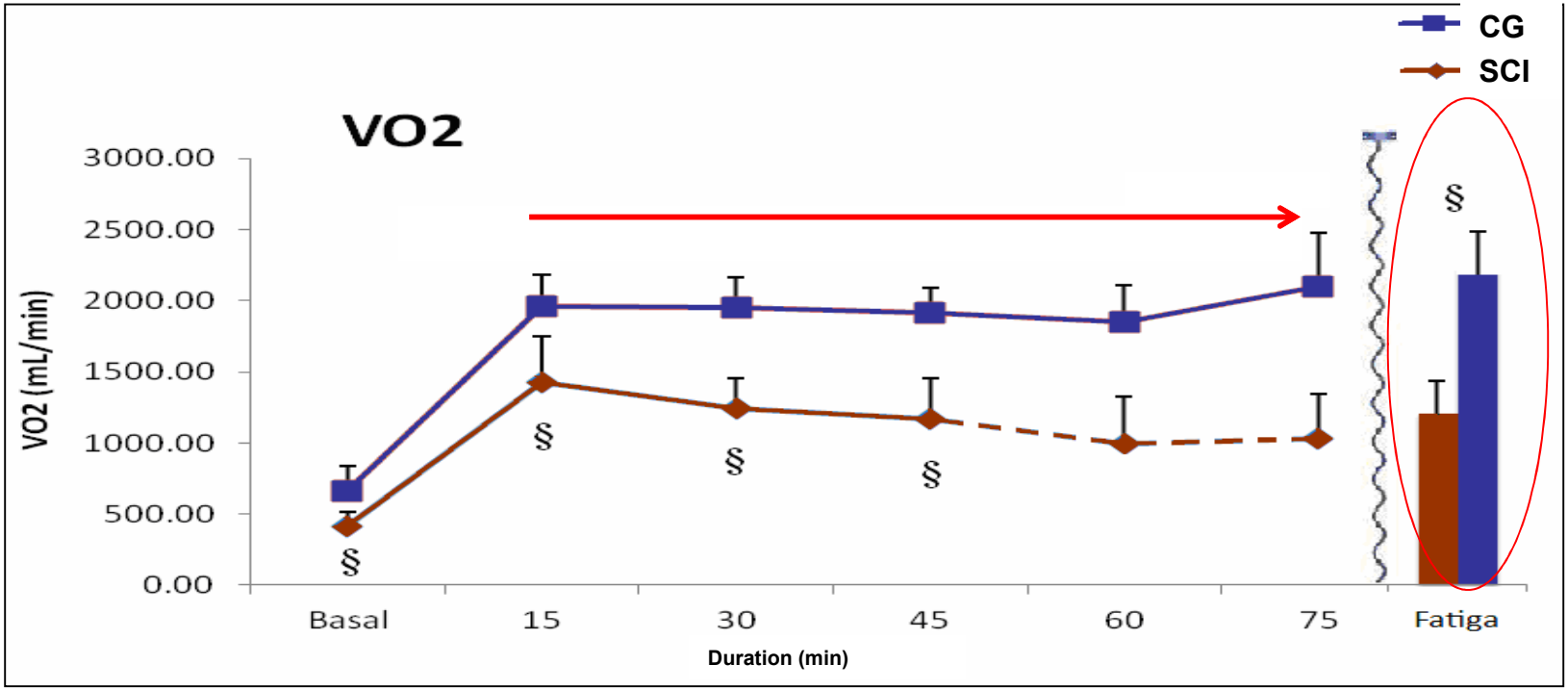
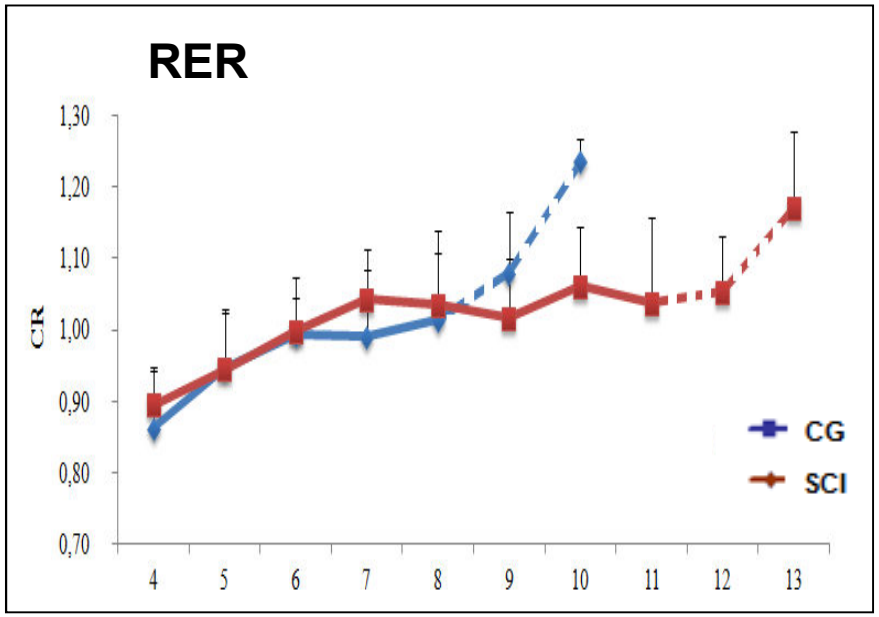
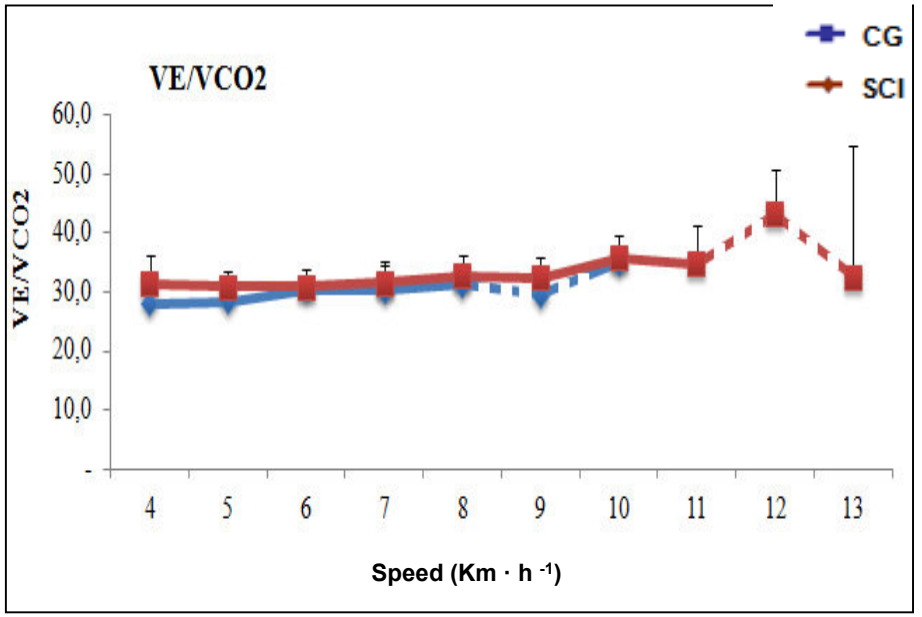


08. RESULTS

INCREMENTAL TEST





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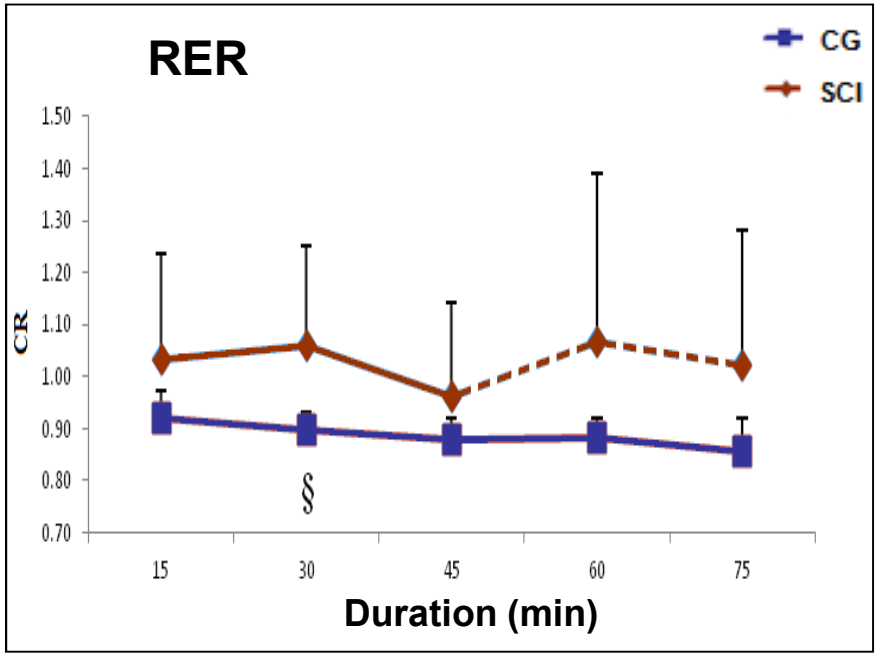
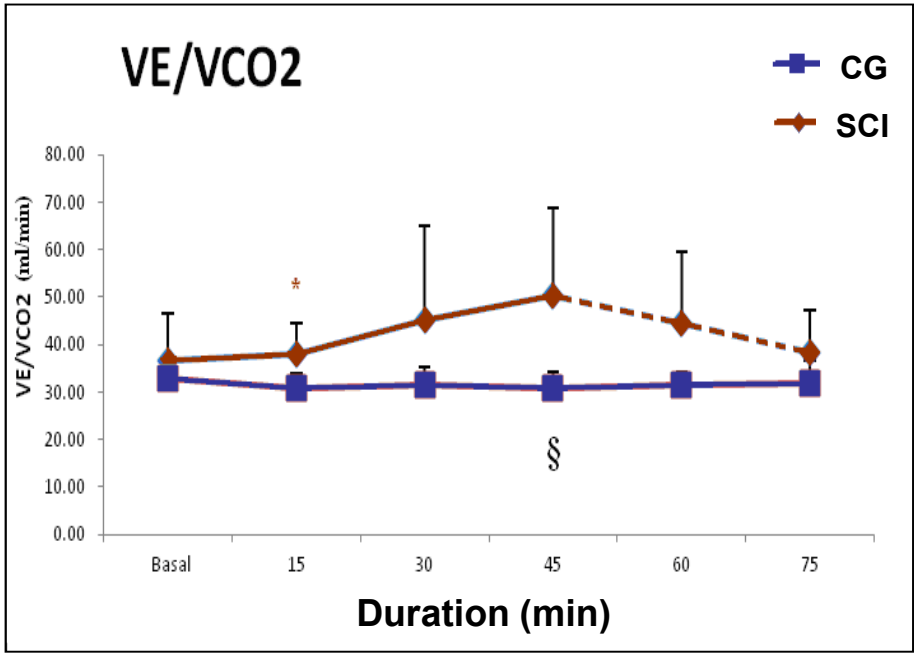
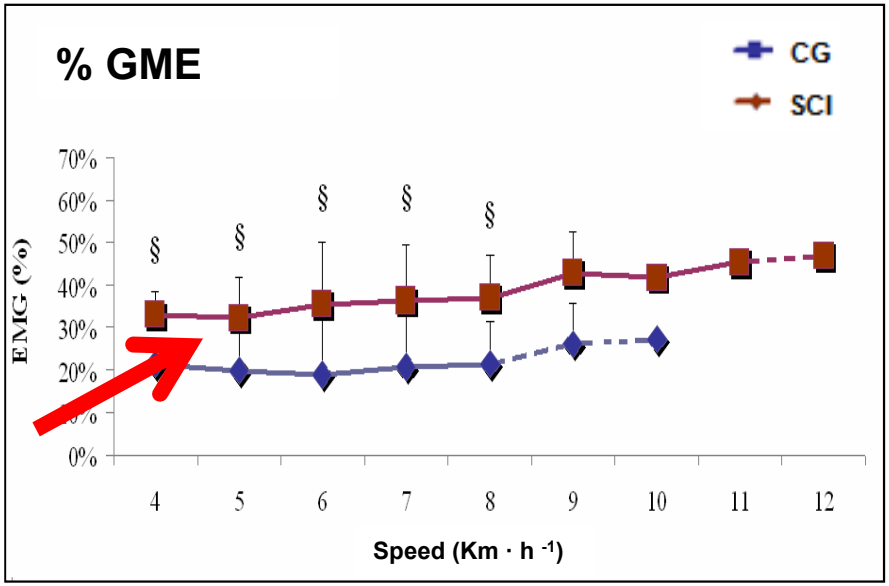


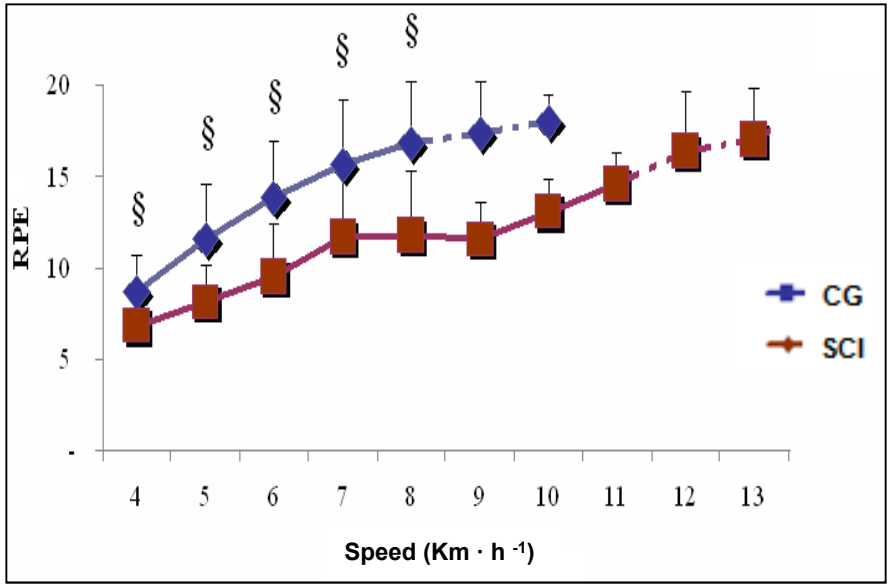


Gross Mechanical Effiency

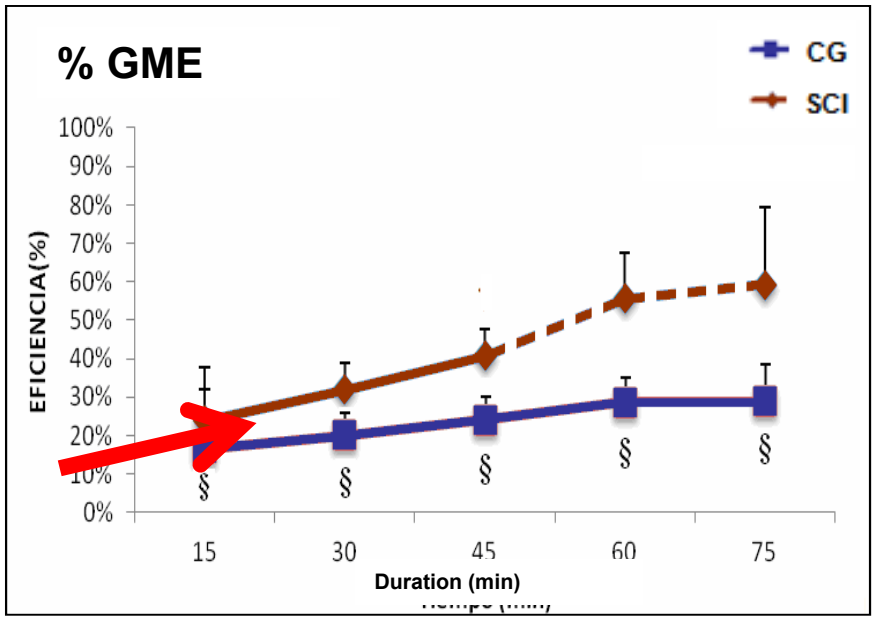
Borg Scale

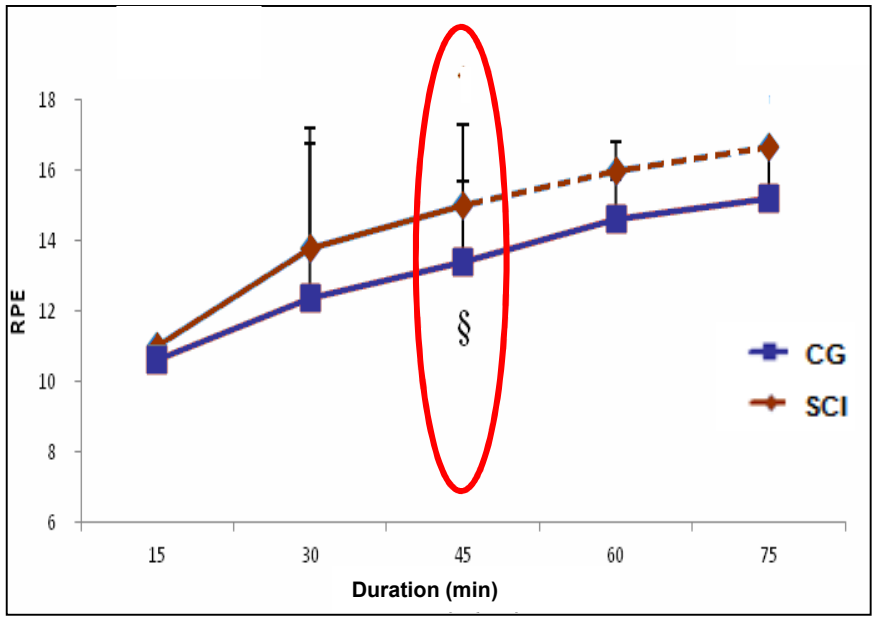
INCREMENTAL TEST





AT TEST





1

- The SCI athletes shows a better physiological adaptation to the high intensity and short duration physical exercise during manual wheelchair propulsion in comparison with the CG.

2

In a long-term duration exercise, the SCI had indicated an increased level of fatigue. This increased fatigue could not be detected through the study of the physiological, metabolic and biomechanical parameters, but it was detected by the perception of the subjective individual effort .

3

- There are some other possible factors beyond the metabolic and cardiorrespiratory parameters through which it is triggering fatigue in the SCI group during a long-term test, and it could be related to a central fatigue that comes from their pathology (i.e pain)

4

Hence it follows that what triggers fatigue in both groups must be different.

Thank You for your attention!

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