



EXERCISE, BODY POSITION AND BREATH HOLDING RELATED TO HEART RATE RESPONSES DURING SYNCHRONIZED SWIMMING SOLO ROUTINES

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Introduction





- Characterize the HR, Lactate, RPE, and VO_2 response
- Training vs competition
- Systematic observation
- Nutritional analysis



Aim

Characterize the HR response in relation to body position and face immersion during solo competitive routines



Methods

Subjects

8 elite synchronized swimmers (n = 11 solo routines)

Age 20.8 ± 4.9 years; height 166.9 ± 9.7 cm

Study design

The study was conducted at the Spanish Open Championships

Approved by the Ethics Committee and by the Refereeing and Organizing Committees

Mixed Methods: Quantitative (HR) and qualitative variables (body position and breath holding status) were simultaneously obtained

HR monitoring

Beat by beat HR was measured using a waterproof heart rate monitor (CardioSwim, Freelap, Switzerland)

Data were interpolated: every 0.04s for each video frame (25 fps) using Matlab (Mathworks Inc., USA)



Video recording

Using a digital video camera (Panasonic AG-DVX100BE 3-CCD)

Observational instrument

Recording instrument: LINC software (Gabín, Camerino, Castañer, & Anguera, 2011)

Observation instrument *ad hoc*:

- 1) face immersion: face-in (FI), and face-out (FO)
- 2) body position: horizontal, upright, and inverted.

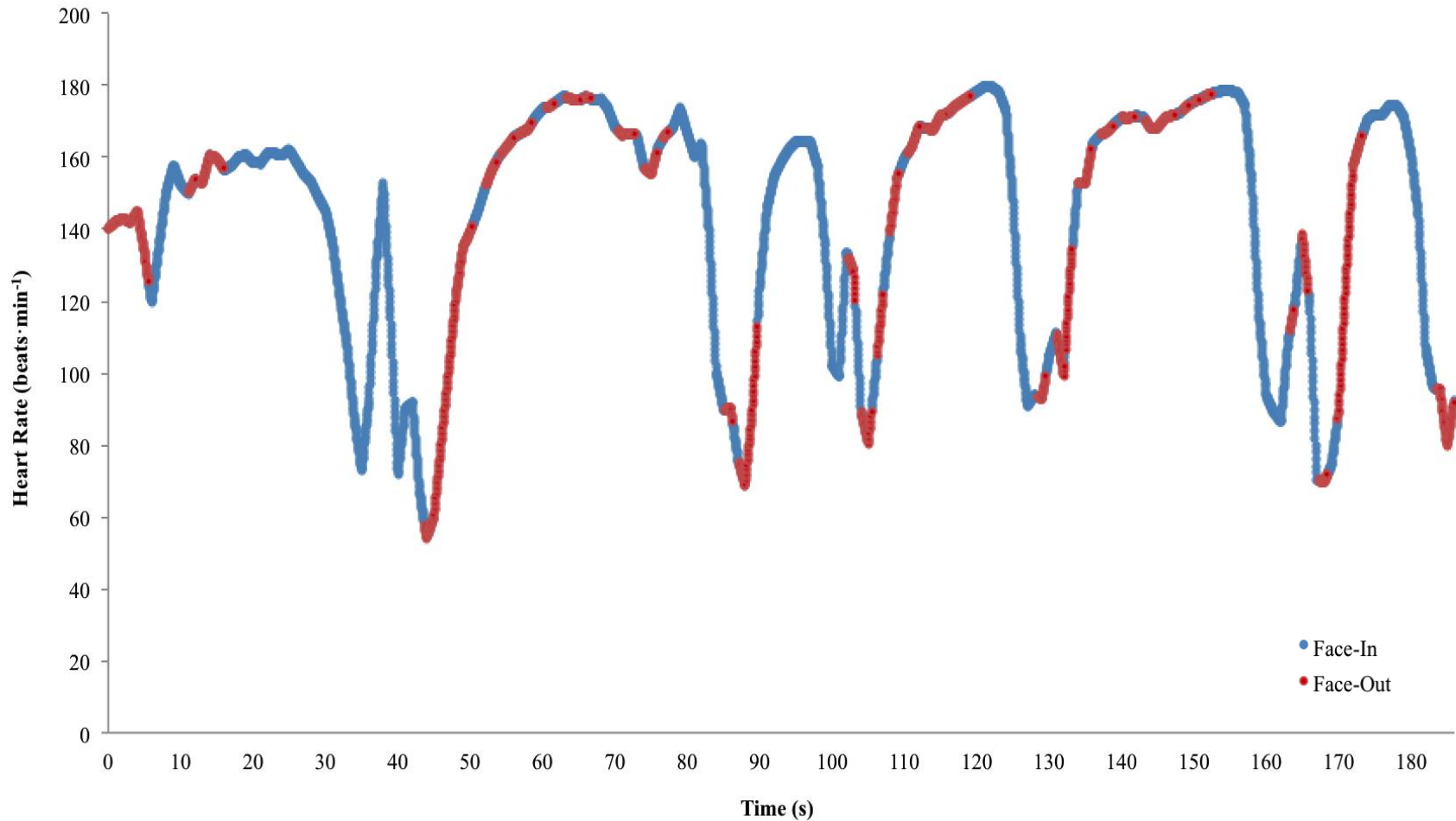
Validity: was determined according to its conceptual consistency and robustness (consensus opinion of SS experts)

Reliability: Inter and intra-observer (kappa values >0.90)



RESULTS

Heart rate response during a solo routine - synchronized swimming



Heart Rate & Body Position vs Breath Holding



	HR (beats·min ⁻¹)			Routine time (%)
Routine Solo	152,3 204,7	± -	30,6 20,0	100%
Face In	150,1 204,7	± -	31,7 * 20,0	62,2%
Face Out	156,1 200,9	± -	28,0 24,8	37,8%
Horizontal	156,0 204,7	± -	27,6 + 23,4	27,9%
Inverted	147,4 200,4	± -	33,6 20,0	40,5%
Upright	155,2 200,9	± -	28,1 24,7	31,5%

* $p < .0001$ Wilcoxon Two-Sample Test

Values: mean $\pm$ SD
(max - min)

+ $p < .0001$ Kruskal-Wallis Test

Breath Holding

	FI routine n	FI mean (s)	FI max (s)
Free + Technical Solo (n=11)	24,5 ± 8,9 41 - 13	4,3 ± 1,2 6,2 - 2,6	21,7 ± 4,4 27,8 - 16,0
Free Solo (n=6)	30,0 ± 7,6 41 - 20	3,9 ± 1,1 5,6 - 2,6	22,8 ± 3,9 27,8 - 16,2
Technical Solo (n=5)	17,8 ± 5,1 25 - 13	4,9 ± 1,1 6,2 - 3,2	20,4 ± 5,0 27,5 - 16,0

Values: mean ± SD (max - min)

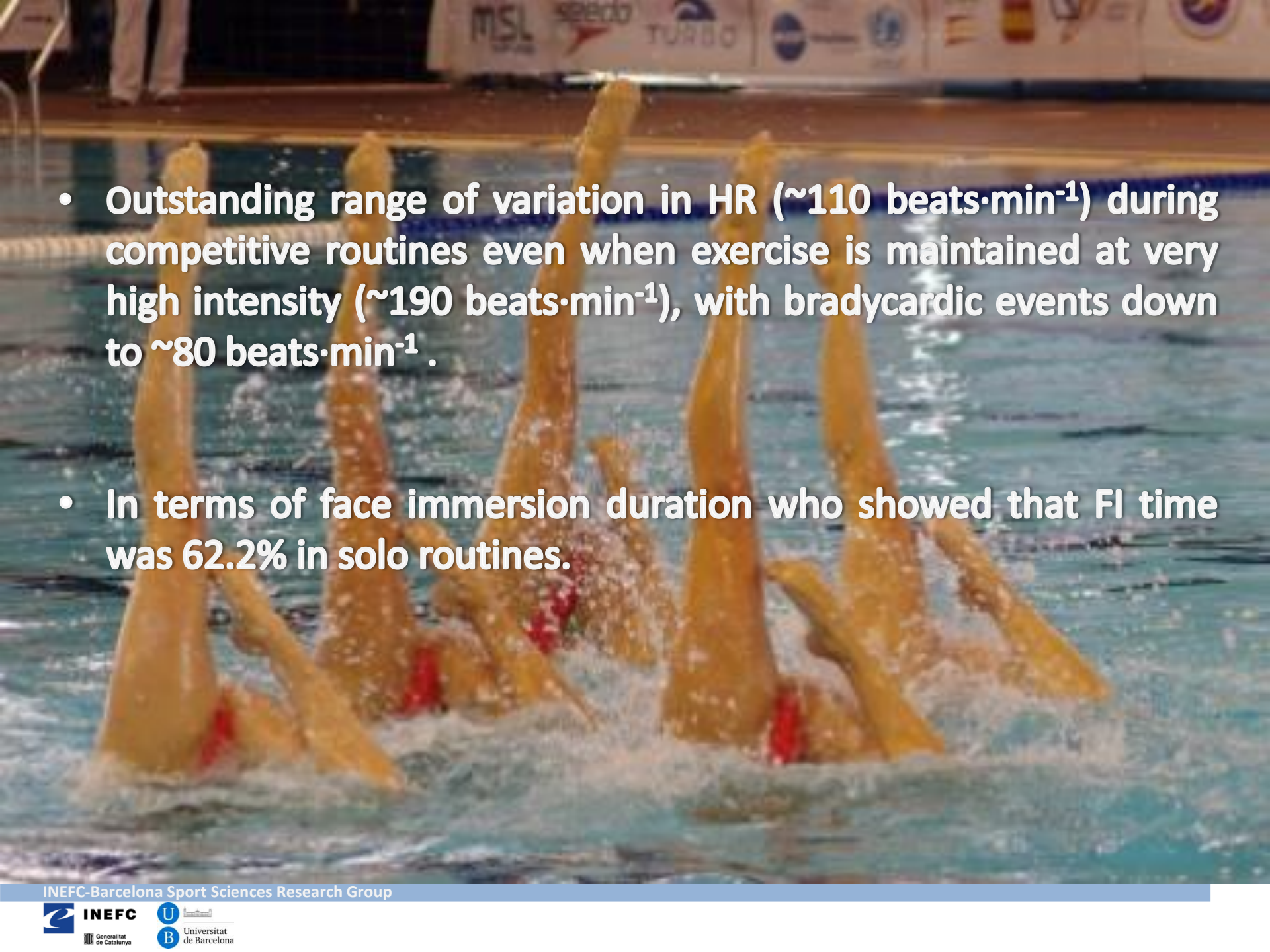
FI = Face Immersion



Conclusions

- 🏊 First study in which the HR has been related to breath holding and body position during SS competitive routines
- 🏊 HR is characterized by progressive, sustained tachycardia, with interspersed periods of intense bradycardia related both to the breath holding periods and to changes in body position.



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- Outstanding range of variation in HR (~ 110 beats $\cdot$ min $^{-1}$) during competitive routines even when exercise is maintained at very high intensity (~ 190 beats $\cdot$ min $^{-1}$), with bradycardic events down to ~ 80 beats $\cdot$ min $^{-1}$.
 - In terms of face immersion duration who showed that FI time was 62.2% in solo routines.



Gràcies - Gracias - Thank You



<http://inefcresearch.wordpress.com/>



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